MODERN HOSPITALS

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MODERN HOSPITALS

A Series of Authoritative Articles on Planning Details and Equipment, As Exemplified By the Best Practice In This Country and Europe

By

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Preface

IT is with the intention of offering to architects and those concerned with the superintendence of hospitals and the care of the sick, some measure of assistance that this book has been prepared. Its text reflects the latest word in each department treated, and the statements set forth may be taken as based on the best practice. The illustrations are a diverse collection of well designed hospitals in their different special or general fields, that have been recently erected, while the names of their designers will be sufficient proof that their architectural treatment is of a character that will afford valuable suggestions to everyone engaged in the field of hospital construction. While a portion of the text and illustrations have found previous publication in the pages of THE AMERICAN ARCHITECT, *much of the material presented in this book has never heretofore been published. Its collection in book form presents a work encyclopedic in character and recommends it as a volume for ready reference.*

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MODERN HOSPITALS

AIRING BALCONY AT BEVERLY HOSPITAL, BEVERLY, MASS.

DETAILS AND EQUIPMENT OF HOSPITALS*

By EDWARD F. STEVENS, A.A.I.A.

HAVE read over the reports of the last three years, as well as the reports of other papers on hospital planning and construction which have been given, and I find that the field has been pretty well covered from every point. It may be that the writer of one paper has insisted that no ward should be larger than six beds, while another states that a twenty-bed ward is the best to administer; that one thinks the utilities should be placed in a corner toilet tower while another believes these utilities should be placed in a less prominent position. In studying these problems of hospital planning with many superintendents in all parts of the world, I am led to the belief that what may be perfect and complete in Northern Canada would be simply ridiculous in Florida; that which would be complete in Germany would be lacking in detail in America; and I believe that the planning of the hospital is unlike the planning of any other building for it must be developed for the climate and the environment in which it is to be built, and no rules can be laid down which would apply equally well to all parts of the country.

*Résumé of an address entitled "Details and Equipment of the Hospital." Delivered by Mr. Edward F. Stevens, A.A.I.A., Before the American Hospital Association at its Thirteenth Annual Conference, held in New York, September 19, 1911. Being a Report of the Hospital Construction Committee.

INTERIOR DOOR FINISH

So I shall not discuss at this time the construction and planning of an hospital, but shall take for my subject the "Details and Equipment of the Hospital"—comparing the American with the European work, and, in taking this branch of the subject, I will not be trespassing so much on the field already covered by my predecessors.

I think it was our own Dr. Emerson who said, in a paper presented a few years ago: "An hospital building is a piece of medical apparatus for use in the treatment of patients." If that is true about the hospital building, is it not more true about the interior details, the equipment and furnishing of the hospital?

By presenting some of the things which I have been able to photograph myself, or to secure from other sources, it will give you some idea of the way other hospital

AIRING BALCONY, UTRECHT, HOLLAND

AMBULANCE ENTRANCE, BROCKTON HOSPITAL, BROCKTON, MASS.

men in other countries, as well as this, have solved some of their problems.

Construction

The interior finish and details of an hospital are of considerable importance when the economic and hygienic side is considered, whether finish is to project with edges and mouldings to catch dust or to have a smooth surface. In the modern German hospitals one rarely sees any projecting member, and I am speaking now of the portion of the hospital set apart for the care of the patients.

The door jamb may be of iron or wood, but it is sure to be of the simplest detail. The iron jamb is quite likely to be continued through the wall and around the opening in tiles as is well illustrated in the private hospital of the "Merchant" in

MATERNITY WARD, UTRECHT

Vienna, or in the plain finish at St. Georg's in Hamburg.

But while this finish above the floor in the foreign hospitals is well-nigh perfect, the joining of the door jamb to the floor in nearly every hospital which I visited in Europe is, to my mind, very bad, as it leaves an untidy angle impossible to clean. If this door jamb is cut away and the base carried through as is shown in the illustration, which was taken in Grace Hospital at Detroit, it is almost impossible for any dirt to collect. This base and jamb is set before plastering, so that every part of the finish is smooth with the wall. This same character of finish should also be applied to the windows. The American door manufacturers certainly make better and more sanitary doors than in any country I have visited. The one-panel or no-panel "slab" doors now being used in the modern American hospitals are to be preferred to those used abroad. The hardware is a small item but should always be selected for its suitability. The angle door knob or handle, as seen in the German hospitals, has many advantages over the glass knob. Invisible hinges, boxed strikers and non-projecting hardware can be used to advantage.

REVOLVING BALCONY, UTRECHT

The ever present question, "What is the best floor?" is often met with and is hard to answer. This question I asked of the leading architects and hospital men in Europe and the almost universal preference seemed to be for tile, a light grey pebble finish vitreous tile; the next favorite for a hard or dense floor was terrazzo, while one would see everywhere on the Continent the Battleship linoleum. This, cemented as it was to the construction and laid against a tile base, made a very hygienic, noiseless floor. One would hardly

SOLARIUM, COREY HILL HOSPITAL, BROOKLINE, MASS.

ever see wood used for floors, while linoleum was used not only for floors but for table tops, stair treads, screens and even for door panels. In my own practice I have found that linoleum is the best all-around ward or private room floor because of its noiseless and sanitary qualities.

The exterior details of the hospital are important but should be made subservient to and expressive of the plan and to fulfill the mission of the hospital. The entrance should be dignified and express its use as far as possible.

The prevailing idea of surgeons and physicians that the patients should be in the open air as much as possible makes it necessary for us to design airing balconies and roof wards. The hospital at Utrecht, in Holland, has many excellent features,

GENERAL WARD AT BEVERLY HOSPITAL, BEVERLY, MASS.

one of them being the extensive airing balconies. These airing balconies are used very extensively wherever they are provided. The roof wards are used extensively in this country. Provision should be made in these roof wards for diet kitchen and toilets the same as for regular wards so that the patients could be cared for night and day if necessary. The airing balcony, however, cannot always be in the sun and the clever director of the Utrecht Hospital has had a

MALE WARD, HEYWOOD HOSPITAL, GARDNER, MASS.

revolving balcony built, which follows the sun or can be placed to shield the patient from the wind.

The solarium is, of course, useful as a day room, but unless well ventilated is apt to get very "stuffy." It can be made attractive with palms and flowers.

Why not make the whole ward a solarium, as was done at the Beverly Hospital? The windows made large, extending low enough so that the patient could look out while lying in bed, and high enough to secure the maximum of sunlight. In the European hospitals, casement windows are used, as well as transoms, but one hardly ever sees the unsanitary roll shades. The washable linen curtains are used and make the ward much more homelike.

Artificial lighting for the general illumination of the ward, using a reflecting light, is much less trying to the patient

GLAZED DIVIDING PARTITIONS, ISOLATING DEPARTMENT, JOHNS HOPKINS HOSPITAL

Note in the illustration of the Heywood hospital that the ward is flooded with sunshine, as each bed is near a window.

In the German and Holland maternity hospitals, the babies are always kept in the same room with the mothers and the draping of the bassinets is sometimes quite grotesque. This hospital at Utrecht was

OBSERVATION WARD, CHILDREN'S BUILDING, JOHNS HOPKINS HOSPITAL

HEATED FOOD WAGON, AMSTERDAM HOSPITAL

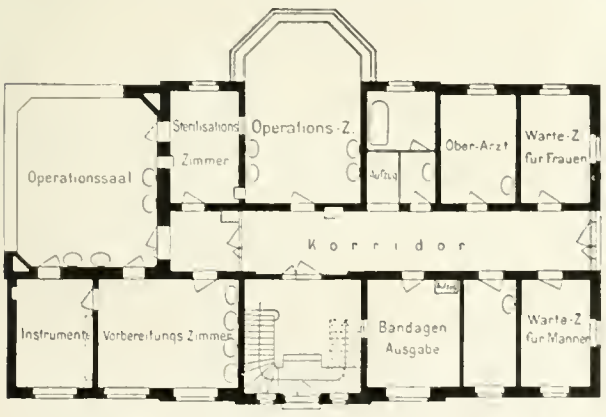
one of the best equipped that we saw. (Note here again the reflected light.)

In the illustration of the interior of Johns Hopkins Hospital, it will be noted that Mr. Butler has used the glazed dividing partitions for the rooms in the isolating department, similar to that seen in the Pasteur at Paris.

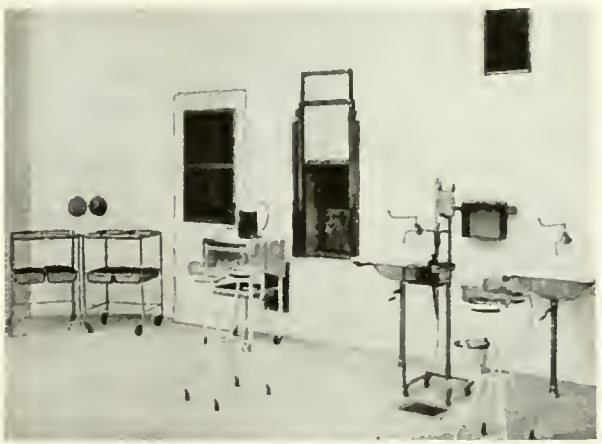
The observation ward of this institution has the unique feature of having in the same room children infected with different diseases, for observation purposes, dividing the cases only by a glass partition some eight or nine feet high. Scrub-up bowls occur along the outside wall. There is a free circulation of air everywhere and why is this not a simple solution of a small contagious hospital? Perhaps the cubicals like the Pasteur, where one room is absolutely cut off from another, would be a little safer; but I believe that for the small contagious hospital, there is no necessity for separate buildings for the different diseases; for with proper isolation of the buildings and precaution by everyone visiting, and the observance of the laws of antisepsis, these cases should be as safely cared for without danger from cross infection as in separate buildings.

Of course, all utensils, china, and everything about the patients should be sterilized, and in this way there should be no necessity for keeping the china of the different cases separate.

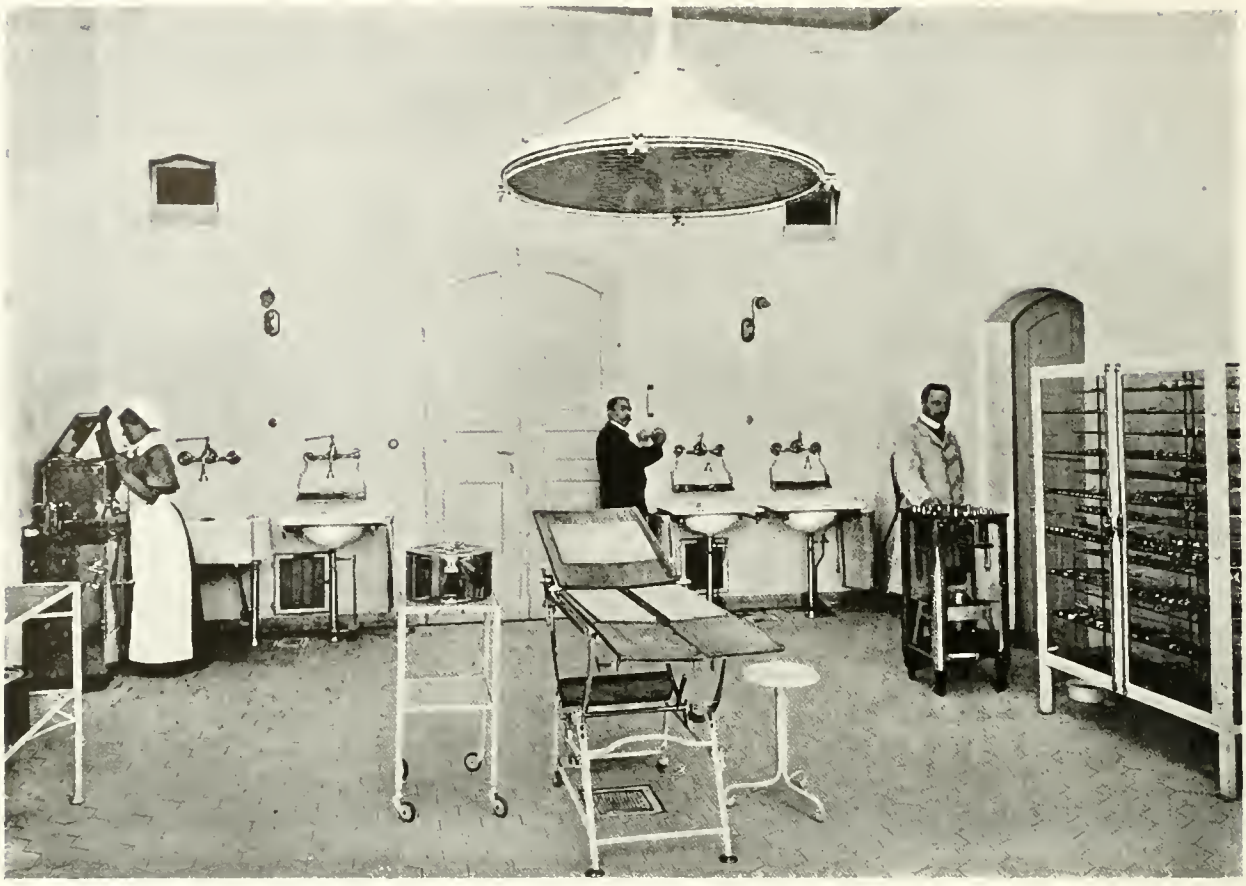
On the Continent one sees very few nurses bed-side calls—either bells or otherwise. The patient must wait until the nurse makes her rounds. In an American hospital, however, nurses' calls from the patient's bed seem a necessity. I cannot recommend too strongly the doing away with the noisy clamor of the ordinary calling system for the nurse and doctor. I think the bell system should be relegated to the shop and factory where noise is expected, as noise begets noise, and no matter how many "*Silence*" signs there are, if the electric call bell is rung whenever a patient wants to turn in bed, there will be other noises to drown the sound of the bell. With the simple devices of electric light calls now on the market, the working of which is simpler than the electric bell itself, I think the system should be so arranged that the patient after once pressing the button could not cancel the call, and, at the same time the nurse should only have to go to the patient and not to the wall behind the bed to cancel it. A system of this nature has just been installed in the Grace Hospital at Detroit. A simi-



OPERATING BUILDING, ST. GEORG'S, HAMBURG



STERILIZING ROOM, BETWEEN ASEPTIC AND CLEAN ROOMS ST. GEORG'S, HAMBURG



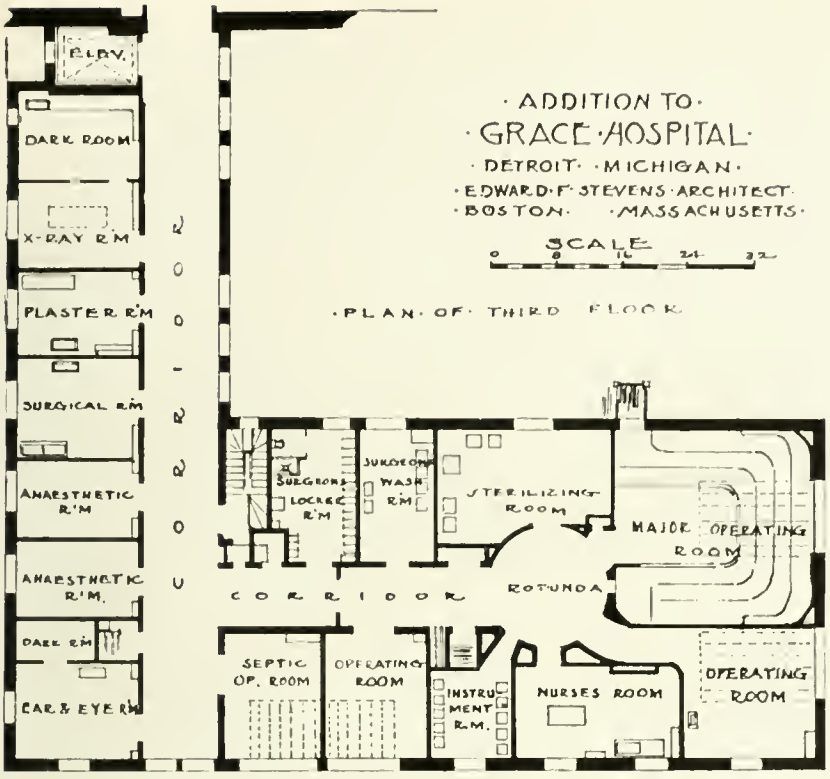
OPERATING ROOM, DRESDEN HOSPITAL. SINGLE LARGE REFLECTORS ARE USED IN MANY ROOMS

REFLECTED LIGHT, UTRECHT

lar system for calling the internes was also installed; the signals are set from the main office and by different colors and positions of electric bulbs the different doctors are signalled to answer. They go to the nearest house 'phone and call the office for instructions, then the call is cancelled.

The conveying of food from kitchen to patients is a very important item in hospital economics. In the great Steinhof at Vienna, where 3,000 patients are scattered over 350 acres of land, the food is carried in electric cars and in an incredibly short time is in the various serving rooms. In the smaller hospitals, push cars are used. At Utrecht, this was a heated car, while in some of the German hospitals the two-wheel cart with cans hung upon the high rails were used. While the simple open carrier is sufficient for short distances, I believe that a food carrier made on the principle of the fireless cooker should be used for long distance transportation.

The equipment of the sink room is growing in importance with every new hos-



pital. Less is made of this room in the European hospitals than our own. The sink room becomes the work room, the laboratory, the repository for all dirty ward work. In this room there should be the sterilizers for stools and bed pans; these with the automatic lifts make the work of absolute cleanliness much easier, also the ward incinerator (and this I consider almost a necessity in the modern hospital); and the sinks, the blanket warmers, the bed-pan warmers, the mops and brooms for cleaning are all essential. This room should have large doors and above all things should be well ventilated, lighted and heated.

Operating Building

It was a very noticeable feature that even in the large German hospitals there were but few operating rooms as compared with the number of patients. Even in the great Virchow there were but four. In the St. Georg Hospital there are but two—a clean and a septic. In the clean operating room the walls on two sides and ceiling are of glass and double, with spaces between for heating of these rooms. The sterilizing room is placed between the septic and clean rooms entering from the clean and from the corridor, there being windows, however, into both rooms, and at those windows are the instrument sterilizers, which can be reached without leaving the operating rooms. The anæsthetic room also joins. The artificial lighting is accomplished by means of three dome-shaped ceiling fixtures with numerous high candle-power lamps.

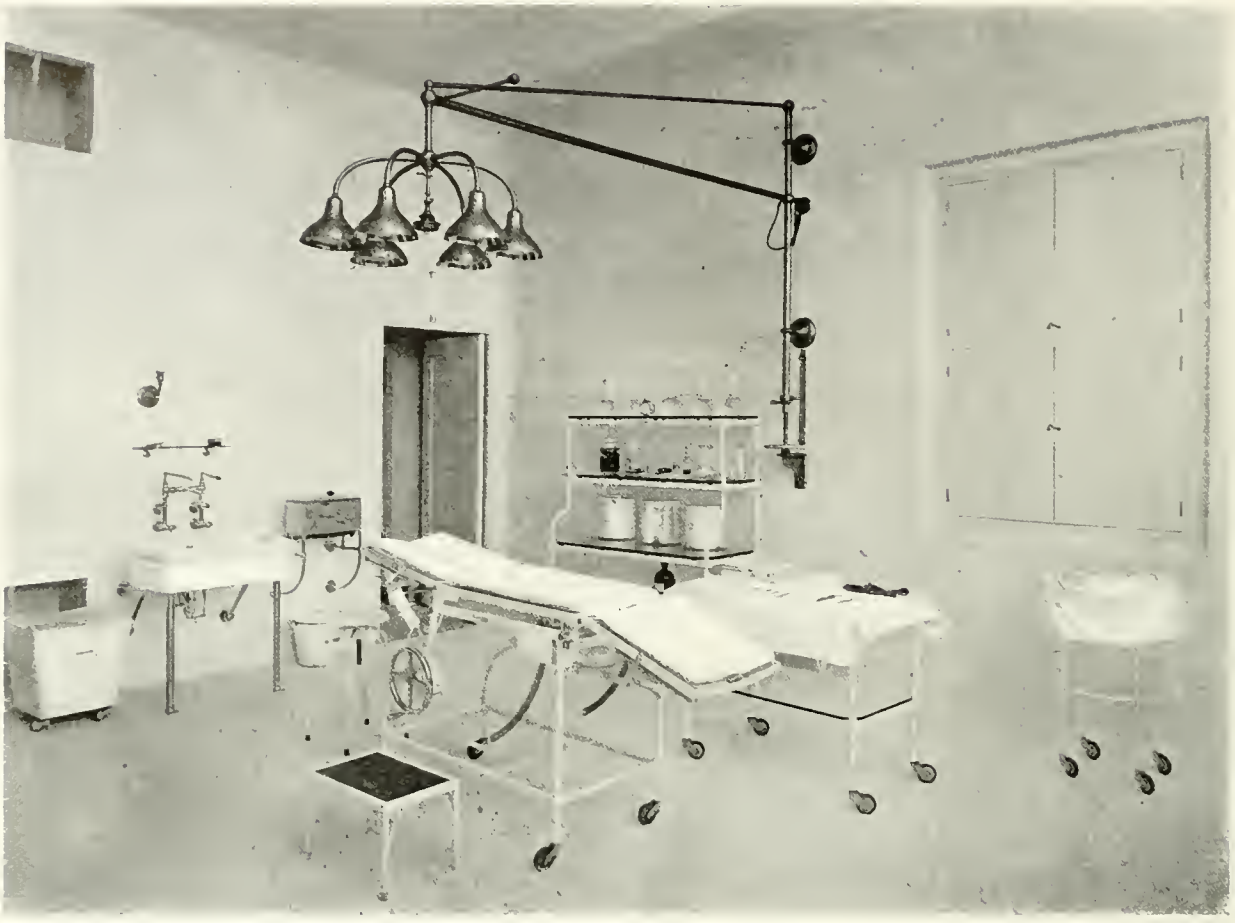
In other German hospitals single large reflectors were used in the operating room.

I have used the type of fixture shown in the illustration with good success. This shows a crane swinging to the centre of an eighteen-foot room; this fixture at the Beverly Hospital has the advantage of being swung back out of the way and leaves no dust-retaining surfaces above the operating table, and can be raised or lowered at will.

We, in our investigations abroad, found that the reflected light from a high power arc lamp in an adjoining room, shining through an opening in the wall and reflected from one mirror to another and thence to the seat of operation, was very successful.

I believe the day of the large amphi-

ASEPTIC OPERATING ROOM, ST. GEORG'S, HAMBURG



OPERATING ROOM, SHOWING CRANE, BEVERLY HOSPITAL, BEVERLY, MASS.

theatre for major operations is past and the smaller rooms with movable observation stands, where the student or observer can get near the patient, should take its place. The view of the Douglas Operating Building at Brockton shows a room which I believe is the most compact and serviceable I have ever seen on this continent or the other.

No hospital nowadays is quite complete without its Roentgen or *x*-Ray room and apparatus. The styles and sizes of the apparatus and character of the work done varies with the institution. The Roentgen Institute, as this department is called in the German hospitals, is made much of—occupying in the case of St. Georg's the entire second story of the operating building.

Bath House

Occupying a position of equal importance with the operating department in the German hospitals is the bath house, this building occupying the same relative position on the medical side that the operating building does on the surgical. In this building are located the various baths as will be seen by the plan, with its electric, steam, sand, douche, brine, CO_2 (carbon dioxide), hydro-electric, etc.

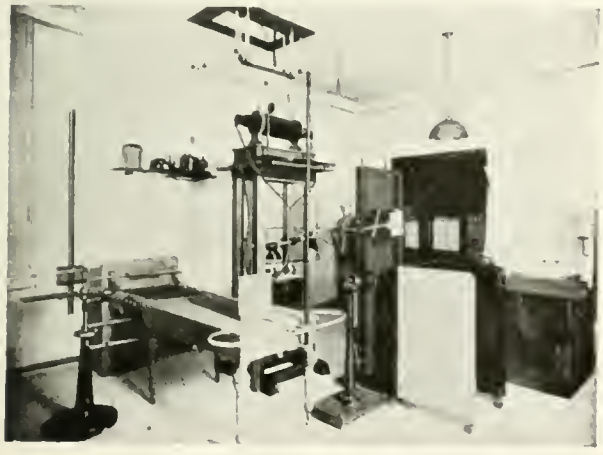
I thoroughly believe that in America we should do more for the medical side of our staff in the way of special rooms and equipment for baths, muscular development and exercise of various forms. It is not uncommon on the Continent to see a well-equipped gymnasium and mechanical massage room in an hospital.

The method of sterilizing and tempering the air in the St. Georg operating room was most interesting. In the section shown through the major operating room you will notice that the outer sash is double and air is conducted entirely around this hollow space—warming in winter and cooling in summer, the floor, the walls and the ceil-

ing. Additional heat in winter is secured from direct radiators behind thin nickel plates in the walls as shown in photograph,

OPERATING ROOM, BROCKTON HOSPITAL, BROCKTON, MASS.

but allowing no air from this source to enter the rooms. The air for the operating rooms is first brought into a clean chamber where it is passed through ground coke, thence over heated coils in winter and ice in summer, through into the fan where it is driven through a filtering substance of fine sand and gravel and thence taken to the operating rooms practically free from all bacteria. The ceiling vents in the operating rooms are closed and there is a



X-RAY ROOM, ST. GEORG'S, HAMBURG

sufficient pressure outward so that the opening of any door would not admit any foul air. This may have been carried to a refinement beyond what would be necessary to follow, but it certainly seemed a well developed plan.

Heating

While it is not my intention to go into the subject of heating and ventilation of hospitals, as that is too broad a subject to take up here at this time, still I want to present a few simple ways which have been called to my attention.

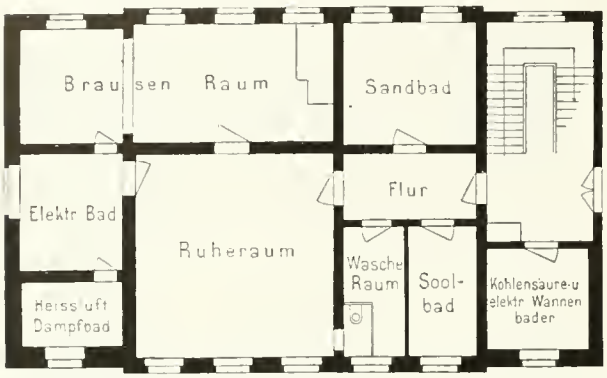
At the Franz Josef hospital at Vienna the combination shown in the illustration

PRIVATE ROOM WASH BASIN, GRACE HOSPITAL, DETROIT, MICH.

is used. This section seems self-explanatory; either the air comes from ducts below —passing over the radiators, or, by manipulating the valves, the air of the room is circulated. I noticed that in the General Hospital at Vienna a system of "direct-

DIRECT-INDIRECT RADIATION, QUINCY HOSPITAL, QUINCY, MASS.

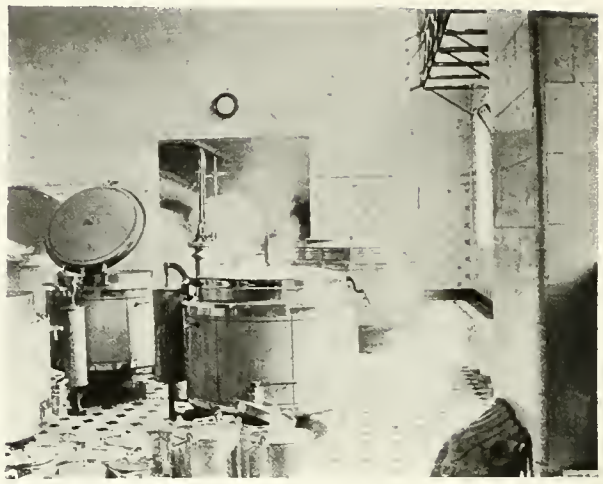
indirect" heating was adopted for nearly all the rooms and corridors, introducing the fresh air from outside at the top of the direct radiator, depending on the natural tendency for cold air to drop. Let me say that I am for simple forms of heating and ventilation for hospitals, for who wants to breathe air at a certain even temperature all day? The patient in bed, covered



PLAN OF BATH HOUSE, ST. GEORG'S, HAMBURG

with blankets, does not need the temperature at seventy degrees or seventy-five degrees and is not comfortable with it. My old professor of ventilation used to say the ideal temperature was that of a beautiful June day in a pine forest in New England; but this would not be at just sixty-five degrees or sixty-eight degrees for the twelve hours, as it would be varied with the movement of the air. A system should be used which would be as near "fool-proof" as possible and not dependant on mechanical means altogether.

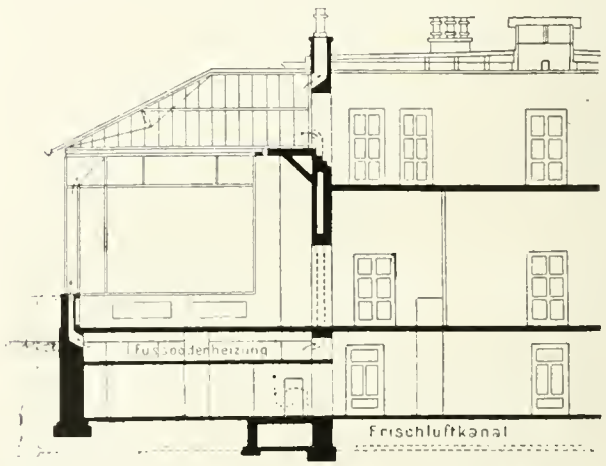
WHEEL STRETCHERS, UTRECHT



STOCK KETTLES IN KITCHEN OF ST. GEORG'S HOSPITAL, HAMBURG

Plumbing

There is perhaps nothing more important in the equipment of an hospital than the plumbing, for through the pipes go all the filth and product of disease and it is most important that this plumbing work be done well and that all pipes and fixtures on the room side of the trap at least be get-at-able for cleaning not only the outside, but the inside as well, that



ASEPTIC OPERATING ROOM, ST. GEORG'S, HAMBURG

enough space around the fixtures should be allowed for cleaning and the simplest form of brackets and supports used.

The bath tub for the patient should, I think, be constructed as to allow the possibility of filling it in the shortest possible time. The large inlet idea like the ocean steamship tubs appeals to me. The over-flow

(if there must be one) should be such that it can be easily cleaned; if the trap is set above the floor the water line is within easy reach of the hand and the pipes can all be cleaned inside. This tub should be set high—making it easy for the nurse to assist if necessary in the bath. With the "bug-a-boo" of sewer gas exploded, there is no reason why the private room, at least, should not have a wash basin. In a type I have used in the Grace Hospital, the bowl and even the shelf and towel rack are away from the wall.

The simpler form of surgeons' scrub-up sinks appeals to me, doing away with the complicated foot and knee valve which has come into popularity within the last ten years and having the simpler elbow valves for the non-hand-touching valve is only wanted after the surgeon has done his scrubbing-up. A page from the catalogue of a German instrument maker shows the development of the elbow valves and the simple brackets and supports. The surgeon can turn on the water to the desired temperature, scrub his ten or fifteen minutes, then with a push of the elbow or shoulder the water is shut off.

I have referred many times to the St. Georg Hospital at Hamburg. I have done this for two reasons: first, that the available material was better, and second, that the St. Georg embodies the greater number of new and "up-to-date" ideas that I found in my visits to over thirty-five hospitals in Europe.

I desire to make acknowledgment to the architect, the man whose study and knowledge of the hospital problems has developed some of the finest things in this line in Germany, and, I believe, in the world, Baurat Dr. F. Ruppel.

MODERN PRACTICE IN HOSPITAL HEATING AND VENTILATION*

By CLARENCE W. WILLIAMS

N this article it is the purpose of the writer to describe, in general, various types of heating systems which have been adopted in modern hospital practice and where they should or should not be used. Only such systems as are applicable to the larger institutions will be considered, as those in the smaller class of buildings depend more upon the resources of the institution than upon their capability of economical operation.

It is unfortunate that the economical side of the selection and design of heating and ventilating apparatus has not been given greater thought and study; but it is the prevalent idea that so long as it is possible to use the exhaust steam from an engine in a heating system, further economy is impossible and if that condition is fulfilled, then the only thing that remains is to install the system that costs the least, regardless of the operating cost.

Considering first the compact or single block hospital, the system generally installed is that using low-pressure steam through the building. In this type of heating, exhaust steam is used with a back pressure on the engines, varying according to the merits of design. The deficiency in the exhaust steam is supplemented by live steam, delivered through a pressure-reducing valve. We have learned by experience that for this type of building such a system, if well designed, with mains of ample size so proportioned as to provide a perfect circulation with one pound pressure and to heat the entire building in the very coldest weather with not more than five pounds pressure, gives good results with a smaller initial cost than any other type of heating system. There is the same fault with this as with every other steam system—namely, that of heat regulation, which is practically impossible except by

*An address delivered before the National Hospital Association.

the addition of a temperature control. This, as it relates to fuel economy, will be considered later.

Where there is more than one main hospital building and the buildings are widely separated, the low-pressure steam system is not so well adapted to these conditions if true economy and first cost be consid-

SERVICE BUILDING, STAMFORD HOSPITAL, STAMFORD, CONN.

MESSRS. GEORGE B. POST & SONS, ARCHITECTS

ered, for, if it is desired to keep the back pressure on the engines within reasonable limits, the heating mains must be very large. On the other hand, if the mains are not properly proportioned for load friction and condensation losses, or if made too small, then the back pressure on the engine is increased, with a consequent reduction in power and increase in steam consumption.

There are many types of vacuum systems—so many that it is hard even for heating engineers to keep informed,—and of these there are but two types which are in general use. One type does nothing but remove the air from the radiators through a system of air pipes, they in turn being connected to a vacuum pump or an injector. Its advantages consist of the removal of air from the radiators, thus increasing their efficiency, the reduction in size of the piping and the reduction of the back pressure on the engines because of the vacuum in the air line system. In a well-designed low-pressure steam plant the addition of such a system is really unnecessary, according to the writer's opinion, especially if the automatic air valves are connected to air lines which are connected together and discharge into a convenient receptacle in the basement, thus doing away with unpleasant odors and discharge of steam and water from leaky air valves. In justice to this system, however, there is no doubt that it works well, gives satisfaction, and could be installed in many heating plants with profit to the institution and comfort to the occupants.

The other type is that in which vacuum valves are placed on the return or condensation ends of the radiators or coils, the bottom of risers, and wherever it is necessary to drain the supply mains; and these valves are connected to the return mains which, in turn are connected to the vacuum pump. This pump handles all the water of condensation in the system and places a vacuum on the whole, thereby making it especially adapted to large installations where otherwise there would be unduly large mains. This system is of value in the remodelling of old steam heating plants, where, through improper design or growth by piecemeal, the piping is too small, thus necessitating the use of live steam at a high pressure to force a circulation. Under such conditions it can make a good showing in economy and justifies its use. Large claims for economy are made for this type of system because of the vacuum, but while undoubtedly, in theory, it ought to be more economical than low-pressure steam, in practice leaky vacuum valves often nullify all the advantages claimed for it. This type of system is found to be of greatest value in large installations where steam is necessary for other uses and where, there-

POWER PLANT, STAMFORD HOSPITAL, STAMFORD, CONN.

MESSRS. GEORGE B. POST & SONS, ARCHITECTS

fore, the one set of mains can serve all purposes. The last feature has often been the deciding point in favor of wholly steam systems over other types and has been made much of—entirely too much, in the writer's opinion.

Another system which is in general use in many large hospitals is the hot blast or so-called Plenum system. This consists of a series of fans or blowers forcing heated air through ducts of brick or galvanized iron into the wards and other parts of the buildings, the air being heated by coils placed alongside the blower, or by radiation at the base of the heat flues. This system has many advantages and has been more generally adopted for large institutional work than perhaps any other, though the cost of maintenance is, no doubt, the greatest. The advantages of this system are the concentration of the heating apparatus at one point, the elimination of all steam piping throughout the buildings, and the ventilation or air changes given. The disadvantages are the cost of operation, the power required to drive the fans, and that, if the air is re-circulated (as is sometimes done to save expense), it then has no advantages over any direct system, but an additional drawback of the extra cost of operating the fan day and night in very cold weather.

In nearly all hospital buildings where ventilation is actually required the method now adopted by the most progressive engineers is to have the ventilation system entirely free from heating; that is, in the rooms and wards is placed sufficient direct radiation to take care of the heat losses through windows and exposed walls and a certain amount of air leakage, the air for ventilation being delivered into the rooms as tempered air at about seventy degrees and in such quantity as is required by the number of occupants and the purpose for which the room is used. By this method the temperature of the room can be regulated to any degree desired, and on pleasant days, when windows or doors may be opened, the fan introducing tempered air for ventilation can be stopped and cost of operation saved, while sufficient heat will be maintained by the direct radiation to keep the building comfortable.

Another type of heating which has recently been introduced by a large manufacturing concern in New York State is that which inserts lines of steam pipes in the construction under the floors and thus warms the rooms by heating the floors only. This is quite a daring departure from any of the so-called "tested and tried" systems, and the writer does not agree that it could be successfully used in modern hospital practice. It may apply to such buildings as factories, where the occupants are on the floors for only a few hours a day, but I do not think a nurse or attendant could work on such a floor the hours required of them in most of our hospitals. The high temperature to which the floors must be heated in order to maintain an even temperature in exposed rooms does not warrant the recommendation of this system for hospital practice, and it will not, therefore, further be discussed.

A type of heating system that is gaining much favor in large institutions as its advantages are becoming better known is the hot-water heating by forced circulation. By this is meant a system of hot water heating in which a circulation is induced by means of a pump placed in the circuit of the mains, the water being heated by either exhaust or live steam or by both. The advantages of this system are economy in steam consumption, ease of control, the maintenance of a constant temperature in the wards, and the ability to run the mains anywhere, regardless of the grades, thereby making possible the location of the power house at a desirable point, which is often not possible with a wholly steam system unless pumps or other devices are installed to return the water of condensation to the boilers or expensive pipe tunnels are built. Some of the disadvantages of this system are that it is necessary to have an independent steam system, as steam is required for other purposes in nearly all hospital buildings; that it requires a greater amount of radiation than a steam system and a consequent greater cost of installation; that it requires greater engineering ability or knowledge of design; and that it must be installed in a more careful and better manner than the usual type of steam systems. One of the great advantages and one that should not be overlooked, is the ability to control the temperature in the buildings

by controlling the temperature of the water and the flow at the power house, besides the individual control of the radiators or coils. That this means much will be conceded when we consider the great variation in temperatures to which we who live in the east are subjected. In the New England States, for example, the temperature varies during the heating season from zero to fifty degrees, and even more. As sufficient radiation must be installed to heat the rooms to seventy degrees in zero weather, and as the average temperature for the heating season in New England is approximately thirty-five degrees, with a steam system of 100 per cent. more steam is used for heating than is actually required. If proper attention could be given and the radiation shut off when the temperature gets above seventy degrees, this would not occur, but, unfortunately, this is not possible where there are a great many radiators or coils and, besides it is much easier to open a window and let the surplus heat escape. In some of the better class of hospital buildings, thermostatic valves are installed on the heat sources, which regulate the temperature of the building by control of the supply of steam to the radiation. Such devices are not only an expense to install, but are often found troublesome to maintain. Their installation the writer would recommend only to the better class of buildings and large wards and clinics where first cost is not to be considered. It may be claimed that it is possible to obtain a degree of regulation with steam by varying the pressure, but, even so, the best that can be obtained by such a method is by the use of high pressure steam direct from the boilers, which is not good practice.

A hot water system is especially adapted to the heating of many widely separated buildings. Where ventilation or rapid air changes are required, fans supplying fresh air or exhausting vitiated air are driven by electric motors. The hot water for all domestic purposes, also for the heating system, is heated at the central plant and all apparatus centralized in the power house.

In summing up the different systems above described, as applicable to modern hospital practice, many, no doubt, will ask the question, "Which is the best of the several recommended?" You will agree with me, I think, when I say that it is seldom, if ever, that a patient is admitted to our hospitals and treated by our physicians or surgeons without a very careful study or diagnosis of the case. The treatment that would apply to one probably would not apply to another. Just so in the question of modern heating and ventilating systems. A study of all conditions must be made and if a competent and reliable engineer be consulted, he will value his reputation as much as the physician and surgeon, and will design a system best adapted to the needs and locality of the institution.

A recent design for a large system of hospital heating and ventilating in the Dominion of Canada where extreme temperatures had to be considered might be referred to. After months of very careful study a combination system was adopted; namely, a forced hot water system for all direct heating and a steam system for all tempering coils. Practically every room in the group of a dozen or more buildings is to be warmed by direct radiation. Tempered air will be introduced to all large wards and operating rooms and such other rooms as require rapid air changes. The ventilation will be entirely independent of the heating system and will be largely by exhaust fans on the roofs controlled by electric motors.

The writer thoroughly believes in natural ventilation as far as possible. There are but very few days during the heating season that the well-trained nurse will not have the windows partly open to admit the health-giving fresh air just as it is provided by the Creator. At such times, the direct hot water heat will probably care for the temperature of the rooms and the tempered air will not be required. Therefore, the fans introducing this air can be shut down and the expense of operation saved.

I have often found entire systems where the wards were wholly dependent upon the introduction of air by fans or under pressure, where, owing to the great expense of operation, the same are not used or only partly so, and, therefore, no air is admitted to the rooms if doors and windows are closed, except what enters by wall or window leakage. In designing the Plenum chambers and ducts, in this instance, they are so

arranged as to introduce constantly tempered air by gravity, should the fans be closed; also, the system of ventilation will be open upon the same general plan by the introduction of aspirating coils either in the flues themselves or at the point of assembly on the roof. In this way, I maintain that while we shall be able constantly to care for our room temperatures by direct radiation, we shall also have a natural gravity ventilating system that will give us from two to three changes of air per hour, even though the exhaust fans be closed down. There are many interesting phases of this combination hot water and steam system that I should like very much to discuss if the time permitted. I will only add, however, that as far as I have been able to learn, this is the first combination hot water and steam system of this nature applied to hospital practice and, no doubt, will be watched with a great deal of interest. I thoroughly believe that for a largely scattered institution located in a cold section of the country, what is now being planned for this modern hospital will prove the simplest, most economical and satisfactory of all systems, in use in modern practice.

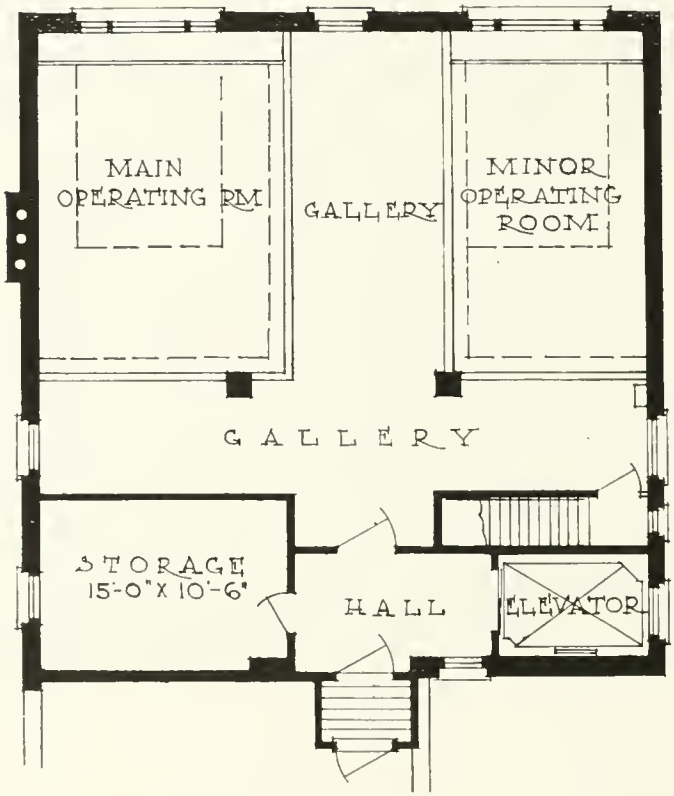
WARD IN SURGICAL BUILDING, NIAGARA FALLS MEMORIAL HOSPITAL

MESSRS. GREEN & WICKS, ARCHITECTS

THE BARNARD SKIN AND CANCER HOSPITAL

MAURAN & RUSSELL, ARCHITECTS

THIS building is fireproof throughout with an exterior of brick and terra-cotta, while the interior is uniformly of reinforced concrete construction with a finish on all walls and ceilings, columns, etc., of Acme hard plaster, painted with impervious enamel paint. While the floors throughout, together with the bases, are of carbolith without joints of any sort, it is hardly necessary to say that all modern hospital requirements were observed, such as rounding of all interior and exterior angles, including the carbolith base, with particular provision on all communicating doors against the necessity of opening by hand and the similar provision against hand operation in the plumbing fixtures. Nothing has been omitted looking to a thoroughly aseptic construction for the particular needs of this kind of a hospital.



MEZZANINE AND ROOF PLAN

The unique features to which we would call particular attention are:—There are two gateways to the hospital, the main entrance for the admission of doctors, staff, nurses and the public and the clinic entrance, which also serves as the entrance for patients. No access is had from the entrance for supplies in the rear or through the special exit provided for the removal of the cadavers.

Briefly, the course of a typical case applying at the hospital is as follows:—Through the clinic entrance *via* the examination rooms the applicant is taken directly to the hydrotherapy which is directly under the clinic and absolutely shut off from the hospital proper. After thorough bathing and cleansing, the clothes having been removed to the sterilizer in the boiler room, the patient is taken in hospital garb to one of the rooms on the main floor in the wing to the north specifically reserved for obnoxious cases. This isolated section is, in fact, a hospital by itself in so far as communication, food, service, plumbing and ventilating are concerned. As objectionable symptoms are ameliorated, the progress is to one of the private rooms on one of the upper floors and as improvement continues, eventually to the ward.

It will be noted that the *absolute* shutting off of one floor from another by means of the enclosed elevator shaft and the enclosure of the stairway in a metal and polished wire glass enclosure, gives as thorough separation as would separate buildings with connecting links.

The laboratory facilities are unusually commodious and complete, as this hospital devotes an unusual amount of attention to

the study as well as the amelioration of the diseases treated.

The operating rooms have the unique feature of permitting the students to observe operations from a commodious mezzanine floor without the danger of infection, which is guarded against by means of a plate glass screen.

The whole effect and result in the use of the hospital during the last six months is of a bright, attractive and thoroughly scientific arrangement covering the particular needs of a skin and cancer hospital.

The Modern Hospital

THE statement has been made that the building of hospitals is a practical expression of man's sense of responsibility for the physical well-being of his fellow creatures. If we accept this definition, the work should command our sympathies, as well as our most profound study. Perhaps there is no class of buildings that demands so thorough an understanding, on the part of the architect, of the various uses to which the different rooms and departments of a building are to be put, as does that to which hospitals belong. In order to design and equip a hospital building in a manner that will render it of greatest value to the community in which it is erected, an architect must combine with the ability of an artistic designer, a knowledge not only of sanitation, heating, ventilation and the various structural requirements of the average building, but also a considerable degree of familiarity with the practice of medicine and surgery. He must by reading and study keep abreast with the progress made in the care and treatment of the sick and diseased, as well as that made in the science of building.

The importance of a full understanding of the essentials in hospital design is realized when we consider that if an error occurs due to an imperfect knowledge of acoustics the architect of a theatre or hall has at worst simply failed to secure for his client the maximum of satisfaction in operation and hence revenue obtainable from his investment. The same might be said in the case of failure to provide adequate facilities for the successful operation of a commercial building. Moreover, these defects would be obvious and probably readily remedied, but in the case of an improperly ventilated hospital or one not provided with proper and adequate sanitary equipment, the lack while perhaps unapparent would nevertheless endanger if it did not cause the positive sacrifice of human life. In view therefore of the complex nature which characterizes hospital planning, and the serious results which must in a measure at least follow any failure to fully realize and amply provide for the various requirements, it would seem to be a duty which the members of the profession owe humanity to thoroughly acquaint themselves with the problems presented, and the solutions already furnished before attempting to meet the needs of any particular situation.

Vacuum Cleaning Systems a Desirable Feature in Modern Hospitals

THE prevailing idea now among the leading hospital authorities is that every hospital of fifty beds or over, where power is available, should be provided with a vacuum cleaning plant. The original piping can be very simply done and should have a sufficient number of outlets to make the work easily accomplished by the attendants. Each outlet should be valved so that the applying of the hose would be done with as little noise as possible so as to avoid disturbing the patients when this work is going on.

The chief advantage of the vacuum cleaning system is that all dust and dirt are taken directly to the receiver without disturbing or distributing the particles of dust or bacteria, which are always a menace where the floor is swept in the ordinary way. For that reason, the portable vacuum cleaner, which exhausts into the air of the room, should be avoided in hospital rooms unless this exhaust is conducted into the open air by a second flexible pipe. The refuse from the cleaner should, of course, be burned and not liberated into the open air. Care should be taken to procure as noiseless a plant as possible for the hospital buildings.—*E. F. Stevens*

The New General Hospital, Cincinnati, Ohio

Messrs. Samuel Hannaford & Sons, Architects

THE typical ward building illustrated has its long axis directly north and south. The basement has ceiling 10 feet high the rooms are from two to four feet out of ground according to the slope of the land. Above the basement are the three stories or ward units and over the double corridor portion or "head-house" of the building is a fourth floor containing a smaller ward and accessory room from which is reached an open roof garden, 100 feet long. This roof garden is surrounded by a parapet about nine feet high, pierced by screened, low-set windows. The basement of all the buildings are connected at the north end by well-lighted basement corridors, the average being ten feet high by ten feet wide.

The ward units as shown in the plan of the first floor present the following features:

To the right of the door, entering the central corridor from the porch is a space communicating with the doors and elevator. This is the "Fresh-Air Cut Off" and measures seven by nineteen feet. This prevents the air from the basement and from the other stories entering into direct communication with the ward. The fresh air enters from the door or transom and is exhausted through the ventilating shaft near the elevator. The "Fresh-Air Cut Off" also permits the complete isolation of the first floor from those above. The central corridor is eight feet wide and sixty-seven feet long and is lighted by large glass panel doors and transoms at both ends. A sanitary drinking fountain is placed in the corridor near the visitors' bench. The serving room or diet kitchen is thirteen by fifteen; the food coming from the central kitchen enters this room through the pass-door and is here divided and, if necessary, reheated. The dining-room for convalescent patients, fourteen feet nine inches by fifteen feet nine inches, can also be used as a day-room should the overcrowding of the ward demand the use of the ward solarium for bedridden patients. The bathroom is nine feet six inches by fifteen feet nine inches. There is a shower on the male side only, experience having shown that women will not willingly take shower baths. This bathroom has both portable and stationary tubs. In the children's room, the tubs are omitted and showers, slabs and sprays take their place. In order that the nurses may attend to their duties in the sink room and yet have all the convalescent patients under observation, who are able to use the bath room, a plate glass four by sixteen has been placed in the partition between the bath and sink room. The sink room has the customary equipment for sterilizing, etc. Leading from the sink room is the nurses' work-room, which is eight feet by six feet nine inches. This room serves the double purpose of a "Fresh-Air Cut Off" between the ward and sink rooms. The work-room is connected with the ward by an open arch, so that the nurse can, even if at work, see the flash signal at her desk at the entrance of the corridor. On the left of the corridor and beginning at the main entrance from the porch, a room for treatment and class-room purposes, twelve feet six inches by fifteen feet, has been planned. The door leading to this room is extra wide, so as to permit the patients being transferred to this room in their beds when it is necessary.

Hospital practice in this country and abroad has demonstrated the necessity for more small rooms in connection with the large wards, where special cases mostly of an obnoxious type can be taken. For this reason there have been placed in these pavilions one two-bed and three single-bed rooms. In order that the various kinds of service may have rooms of adequate size for treatment and lecture rooms adapted to their special needs, it has been so planned that the partition between the treatment room and the two-bed ward, which is eleven feet by sixteen feet nine inches, can be moved, thus enlarging the lecture and treatment room and reducing the double room to a one-bed room. The doors, leading into each of the small rooms, will have a peep-hole covered with a movable metal plate, so that the nurses passing down the hall can inspect the room without disturbing the patient.

The architects believe that it would be extremely wise now to plan liberally enough to provide for future development and therefore additional small rooms have been planned for carrying out new methods of

treatment that are sure to develop in the future. The inside measurements of the ward are ninety by thirty by thirteen feet. It contains twenty-four beds, giving 112½ square feet of floor space and 1,446 cubic feet of air space for each bed. Each bed stands between two windows which extend to the ceiling. The heating is by means of hot water pipes and by indirect method. The other details of the ward building may be readily determined from the plans that are published herewith.

STAMFORD HOSPITAL, STAMFORD, CONN.

MESSRS. GEORGE B. POST & SONS, ARCHITECTS

SOME ESSENTIALS OF HOSPITAL HEATING AND VENTILATION

By D. D. KIMBALL

IT is noteworthy that the many years of hospital construction in this country have entirely failed to produce an accepted standard or method of hospital heating and ventilation. This is not so strange as it may seem if consideration be given to the almost infinite variety of physical conditions and needs of hospital patients and of the nature of the buildings and their surroundings. Manifestly a method of treatment for a hospital for the ruptured and crippled who, in a general sense are not ill, is not suitable for a hospital for contagious diseases or for a surgical ward. Nor is the method suitable for a hospital in the open country adaptable to a hospital built within city limits, particularly if the city in question be one with an atmosphere like that of Pittsburgh.

There is still a wide difference of opinion as to the merits of artificial ventilation as applied to hospitals. A prominent hospital expert recently made the statement that there was no such thing as a ventilating system for hospitals, that clinical records in one of the largest hospitals of New York City proved that the best results were obtained in the wards in which no artificial ventilating system was used, free use being made of the windows. The statement was also made that the air was "roasted" in passing through the heaters to a temperature of 400 degrees, the absurdity of which statement becomes apparent when it is recalled that the temperature of the steam used for heating rarely exceeds 225

degrees, while to reach a temperature of 400 degrees a steam pressure of over 300 pounds per square inch would be required. Investigation led the writer to the conclusion that the opinion expressed was based upon an experience with an antiquated, inefficient and insufficient system of ventilation. The windows, in some cases, were not only shut at all times, but screwed fast or locked, the key in the latter case, being in the hands of the Superintendent.

Recently a hospital building has been built without a system of artificial ventilation, entire dependence for ventilation being placed upon the windows. An unfortunate experience may safely be predicted for this building.

It is granted that under many conditions no better ventilation may be had than natural ventilation through properly constructed windows, a fact too little appreciated by many designing heating and ventilating engineers. But there are many conditions within the wards under which it is desirable to close the windows, many days when inclement weather makes opening of the windows undesirable or impossible, and many more days when, because of the direction of the wind, absence thereof, or because of a sultry atmosphere, no ventilation may be had through the windows.

Artificial ventilation, as an adjunct to natural ventilation, is an absolute necessity if the best results are desired, as is well evidenced by the increased numbers of cures and lessened time required for recovery in ventilated hospitals.

Actual examples or proofs of the value of hospital ventilation are comparatively rare because of the difficulty of obtaining like conditions for comparison, time element, etc., but in school and commercial circles illustrations are abundant.

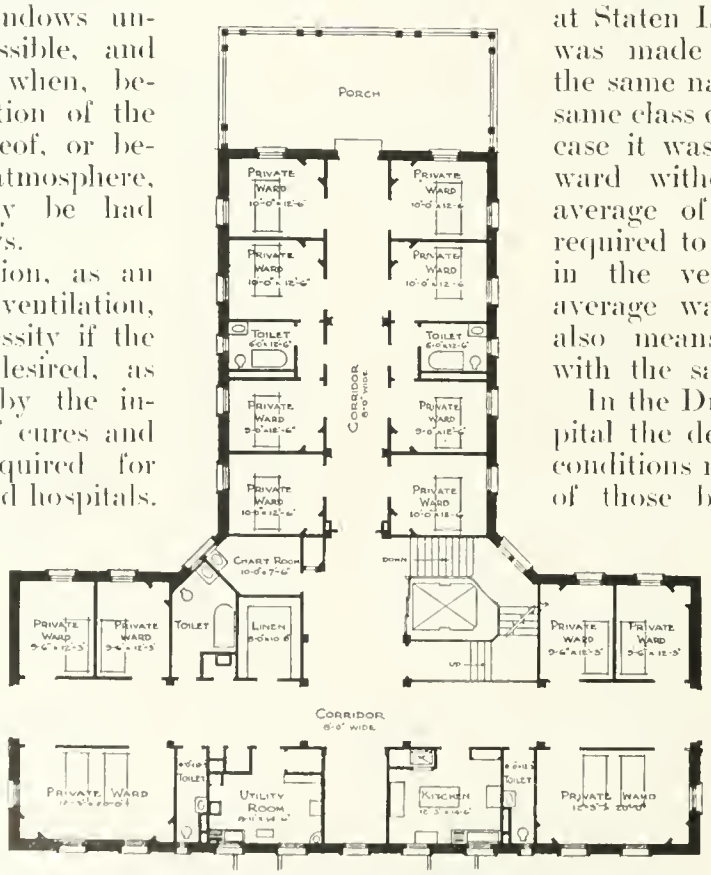
In no place is thorough ventilation so truly a requisite as in hospitals. Shocks due to accidents or a collapse sometimes attending surgical operations reduce the vitality and render the patient unusually susceptible to improper surroundings. The vital resistance is diminished, or in some cases apparently lost, by disease, making necessary the most helpful of surrounding conditions. The patient is acutely susceptible to the effect of improper hygienic surroundings. Pure air, proper medicine, the best of food and skilled attendants are of equal importance.

The reports of the Boston City Hospital show that improved general sanitary conditions in that institution changed the death rate from forty-four per cent. to thirteen per cent. In the general wards of the same hospital the sanitary improvements effected changed the death rate from twenty-three to six per cent., or nearly in the same ratio as in the surgical wards.

At the S. R. Smith Infirmary at Staten Island a comparison was made in two wards of the same nature containing the same class of patients, in which case it was found that in the ward without ventilation an average of sixteen days was required to effect a cure, while in the ventilated ward the average was ten days. This also means a greater work with the same equipment.

In the Dublin Lying-in Hospital the death rate under old conditions reached 50 per cent. of those born, while for an equal period with improved sanitary conditions, including ventilation, drainage, lighting and disinfection, the death rate fell to five per cent.

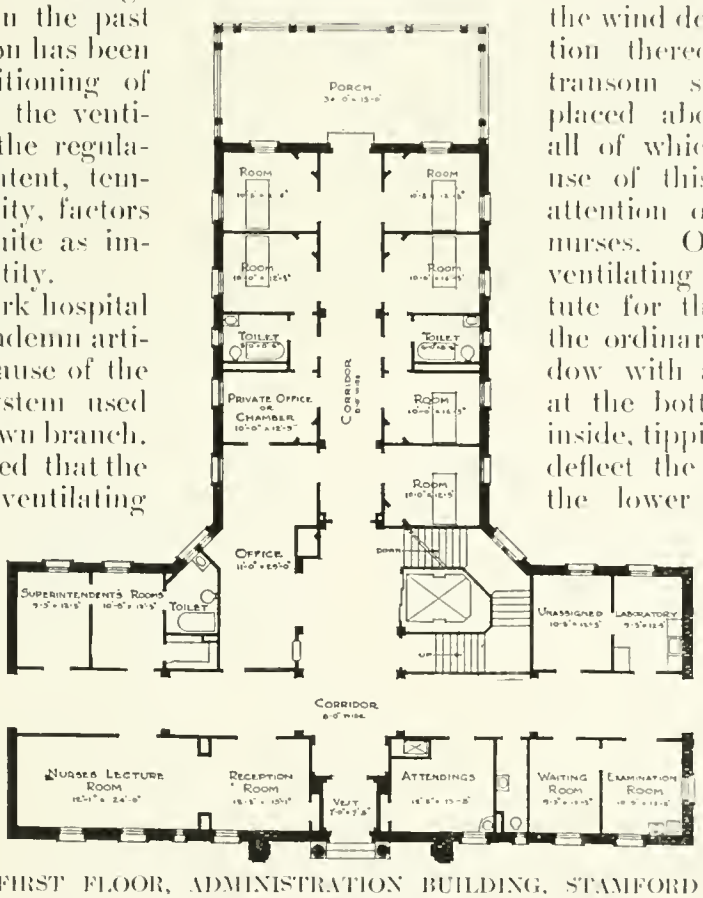
Certain it is that the hospital



SECOND AND THIRD FLOORS, ADMINISTRATION BUILDING, STAMFORD HOSPITAL, STAMFORD, CONN.

patient with his weakened vitality should be provided with the best possible surrounding conditions. Every possible care is exercised in selecting the patient's food and drink. Inasmuch as the amount of air a normally healthy person breathes is 3,000 times by volume and twenty-five times by weight, the dry food eaten, should not the greatest possible care be exercised in providing suitable air for breathing? It is probable that in the past too little consideration has been given to the conditioning of the air provided by the ventilating system, *i.e.*, the regulation of its dust content, temperature and humidity, factors now regarded as quite as important as air quantity.

A certain New York hospital board was led to condemn artificial ventilation because of the results with the system used in their large downtown branch. Investigation disclosed that the air intake of the ventilating system was through an area at the sidewalk level on one of the busiest thoroughfares in the city, no means of filtering the air were provided, humidification was absolutely neglected, no system of temperature regulation was installed, and the size of the ducts and location of registers indicated that the volume of air had been too small, its temperature too high and its diffusion nil. The heating apparatus was crowded into a space altogether too small, thus permitting of no additions or improvements. And be it noted that cramped spaces and failures of ventilating systems are intimately related. A cloud of dangerous dust reached the rooms with the operation of the system rather than a stream of revivifying air. Small wonder, therefore, that the system was condemned. It is unfortunate, however, that such samples of artificial ventilating systems should be quoted as objections to the installation of modern and efficient systems.



FIRST FLOOR, ADMINISTRATION BUILDING, STAMFORD HOSPITAL, STAMFORD, CONN.

The first essential of hospital ventilation is ample provision for natural ventilation, that is, plenty of window openings with properly arranged windows. An arrangement of the windows frequently advocated by hospital experts is the casement window opening out in halves, half of the window to be thrown out to catch the wind depending upon direction thereof, a top light or transom swinging in, being placed above for night use, all of which is good, but the use of this requires constant attention on the part of the nurses. Of itself it is not a ventilating system. A substitute for the above window is the ordinary double-hung window with a plate glass shield at the bottom of the window inside, tipping in at an angle to deflect the air upward when the lower sash of the window is raised.

Open air balconies may hardly be considered as a part of, or essential to, a ventilating system, but they are doubtless essential to the equipment of a modern hospital, some experts maintaining that at least fifty per cent. of the floor area of a hospital should be out of doors.

Quite as important as this provision for natural ventilation is the provision of a system for the positive supply of fresh air when the natural supply must be shut off or is not dependable. This may take the form of a fan system, and usually should for a large building or a building within a city, or it may consist of a gravity system in the case of a small building, the latter lacking the advantages of positiveness and the difficulty of applying filters or satisfactory humidifying devices thereto.

Essential to the full success of either the

ADMINISTRATION AND WARD BUILDINGS, STAMFORD HOSPITAL, STAMFORD, CONN.

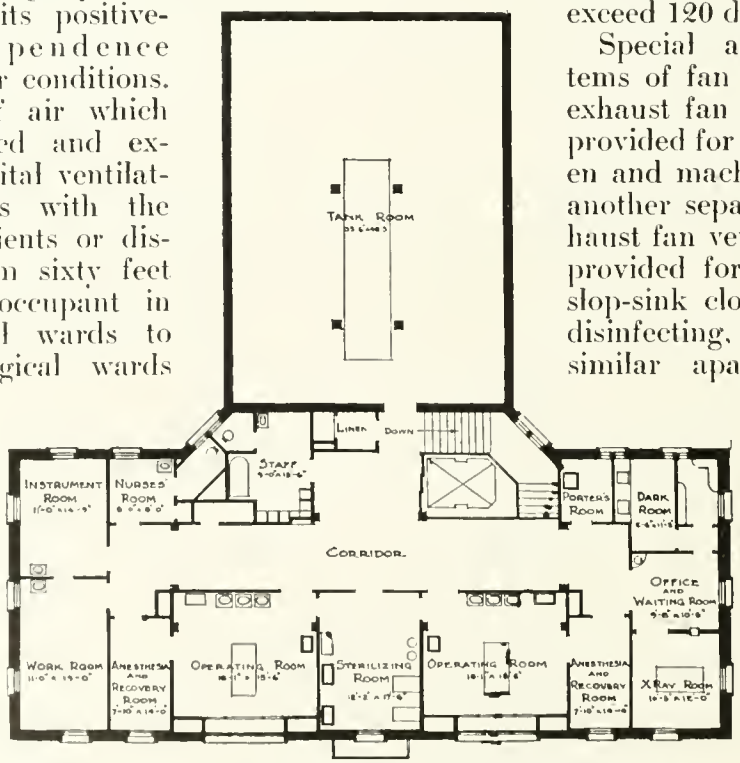
MESSRS. GEORGE B. POST & SONS, ARCHITECTS

natural (window) or artificial ventilating system is a system for exhausting the vitiated or foul air. This, too, may take the form of either a gravity or fan system, the latter system being preferable because of its positiveness and independence of varying weather conditions.

The amount of air which should be supplied and exhausted by a hospital ventilating system varies with the nature of the patients or diseases treated, from sixty feet per minute per occupant in general medical wards to 100 feet in surgical wards and wards ministering to severe cases, and 130 to 150 feet in operating rooms and in wards for contagious diseases, the aim in the latter case being not alone to give the patient the maximum of help but to protect those not inoculated.

In the case of wards heated entirely by indirect heat the quantity of air supplied should, in any case, be so great that the temperature thereof need not exceed 120 degrees at any time.

Special and separate systems of fan ventilation by the exhaust fan method should be provided for the laundry, kitchen and machinery rooms. Also another separate system of exhaust fan ventilation should be provided for all toilets, baths, slop-sink closets, mop closets, disinfecting, refuse rooms, and similar apartments. It is especially important that this be made a separate system of ducts with its own fan and motor. It will thus be a smaller system which should be kept runningtwenty-four hours a day and 365

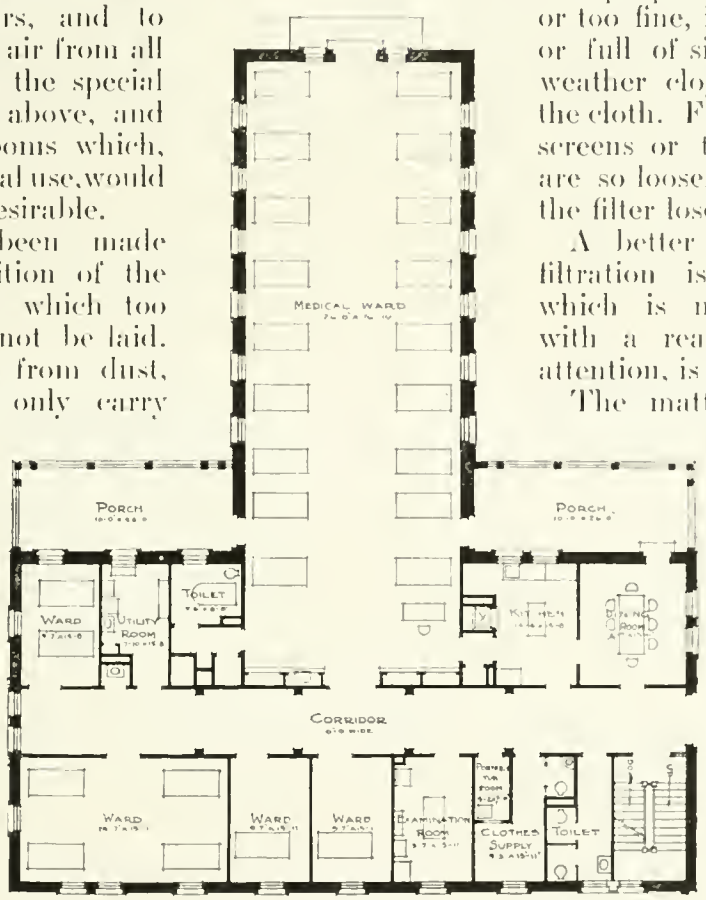


FOURTH FLOOR, ADMINISTRATION BUILDING (OPERATING PLANT) STAMFORD HOSPITAL, STAMFORD, CONN.

days a year, whereas in but few cases are the main exhaust fans operated during the summer, although it is frequently desirable that they should be. The proper rate of air changes in the rooms connected to this special system will vary from twelve to twenty per hour.

A general rule for air supply and exhaust is to supply air to all rooms into which patients may enter, and also to the corridors, and to exhaust the vitiated air from all such rooms, from all the special rooms referred to above, and from any other rooms which, because of their special use, would make ventilation desirable.

Reference has been made above to the condition of the air, a subject upon which too much emphasis cannot be laid. It should be free from dust, for dust may not only carry disease germs but it is a serious irritant, and if it reaches the respiratory systems of the patients it may inflict injury therein, and render the patient liable to further disease because of its physical and germicidal properties. Also, it is believed by some scientists that the dust contains much vegetable matter from which, when coming into contact with heating surfaces at a high temperature, there may be distilled harmful gases. Trouble from these sources may be obviated by removing the dust from the air used for ventilation by means of filters.



FIRST AND SECOND FLOORS, WARD BUILDING, STAMFORD HOSPITAL, STAMFORD, CONN.

It is most desirable that the air intake should be high, as high as the roof line if possible. Actual tests by Dr. Graham Rogers, of the New York Department of Labor, demonstrated that there is but about one-seventh to one-tenth as much dust fifty feet above the street as at one foot above the sidewalk. He also found that there was a lessened proportion of oxidizable matter and of carbon dioxide in the air at the greater height.

Regardless of the location of the air intake all air entering the hospital through the ventilating system should be passed through air filters. These may be of the cloth type, although much of the cloth used for this purpose is either too coarse or too fine, insufficiently strong, or full of sizing which in damp weather clogs the openings in the cloth. Frequently these cloth screens or the frames therefor are so loosely put together that the filter loses its value as such.

A better apparatus for air filtration is the air washer, which is more thorough and, with a reasonable amount of attention, is easily kept in order.

The matter of dust suggests the importance of proper construction of air chambers and air passages. All sides thereof should be finished perfectly smooth and should be as accessible as possible, that the interior surfaces may be occasionally cleaned, and that they may not become culture tubes for the propagation of germs. To this end sheet metal flues are desirable, but where masonry chambers, ducts or flues are used they should be finished perfectly smooth.

It is desirable also that air chambers should be subjected to as much daylight as possible, especially sunlight, because of the germicidal properties thereof.

Humidity has been referred to as one of the essentials of good ventilation. Relative humidity and temperature are most intimately associated. It is true that a temperature of sixty or sixty-five degrees with a relative humidity of fifty or sixty

per cent. is more comfortable and healthful than a temperature of seventy or seventy-five degrees with a relative humidity of twenty per cent., the latter condition being frequently observed in our homes, schools and hospitals during the winter. This dry atmosphere is trying to the eyes, nasal passages and skin, it produces nervousness and sleeplessness, and because of the evaporation of moisture from the body, which rapidly absorbs heat, it causes a feeling of cold despite the high temperature. In marked contrast is a reasonably humid atmosphere of the lower temperature, say fifty to sixty per cent. and sixty to sixty-five degrees, in which freedom is had from the above annoyances and restfulness prevails.

It is not true, however, that the temperature may be lowered and the humidity raised with a resulting saving in fuel, for it takes vastly more fuel to evaporate into the air the amount of water required to raise the humidity than is saved in the five, or even ten, degrees less to which the air is heated. In determining the capacity of the boiler and in considering the fuel consumption allowance must be made for humidification. Inasmuch, however, as it means the difference between healthful and trying surroundings, between bright cheeks and eyes or sallow cheeks and dull eyes, between wide-awake minds or dull minds, and even between preservation or destruction of furniture, it is urged that humidification is well worth its cost. Doubtless within five years, or ten at the most, a hospital or school without provision for humidification will be regarded as inefficiently equipped.

The moisture for humidification may be introduced into the air-supply system by means of steam jets blowing directly into the air, by means of vaporizing pans containing steam coils, or by means of the air washer to which reference has already been made.

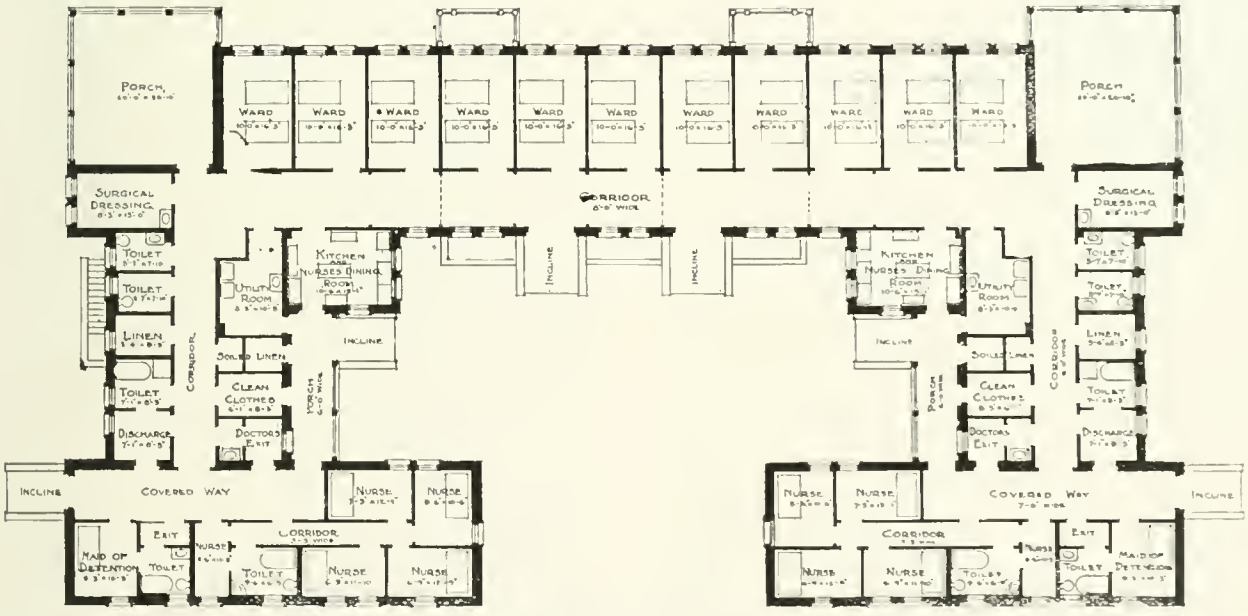
The first method has many objections, the second serves but the single purpose of humidification and is not so well adapted for large installations, while the third method serves the double purpose of humidification and air filtration, and in the most convenient manner, especially for large installations. Nor is the cost of the air washer greatly in excess of that of a really well constructed cloth air filter. Its manipulation is easier and expense of upkeep little different. Discrimination should be exercised in selecting the type and make of air washer, as not all of them are entirely successful.

The relative humidity may be automatically regulated by means of the humidostat in much the same manner as temperature is automatically regulated.

We are much less apt to suffer willingly from a temperature too low than from a

temperature too high, but as a matter of fact an excessively high temperature, especially if accompanied by a high humidity, may cause a rise in bodily temperature and even serious functional disturbances. Inasmuch as sufficient radiation must be provided for the coldest but most infrequent day of the year it is not strange that the complaint is frequently, and usually unjustifiably, made of too much radiation. Manual control is almost impossible of success and an automatic temperature regulating system therefore becomes an essential part of a complete hospital heating and ventilating system, and it is an economical device as well.

The subject of direct versus indirect heat for hospitals is much discussed. The direct radiators have the advantage of making possible the quicker and less expensive warming up of the rooms upon the closing of the windows and of giving the patients a place to warm feet or hands at such times, the absence of which in rooms without



WARD FLOOR, CONTAGIOUS WARD BUILDING, STAMFORD HOSPITAL, STAMFORD, CONN

direct radiators, is often criticized by doctors.

The amount of direct radiation used in rooms occupied by patients may well be limited to an amount sufficient to counterbalance the heat losses through wall and glass areas. It should not be used in operating and similar rooms. If amply supplemented with a fresh air supply and foul air exhaust by means of the ventilating system, and if they can be so placed as not to be too close to patients, their presence is usually regarded as desirable, but in such cases several small radiators generally distributed are preferable to a less number of large radiators which concentrate the heat. The radiators should be plain and smooth and should be supported from the walls without legs with a space of two inches back of them so that they may be kept clean as well as the wall and floor areas in the vicinity.

Concealed piping for the heating system is regarded as preferable in that it lessens available places for the deposit of dust.

Some consideration is being given by the medical fraternity to the subject of artificial cooling of hospital wards. In view of the results of recent investigations as to the effect of excessive temperature and humidity it is reasonable to expect that much good may be accomplished in severe cases by lessening the temperature and humidity within the wards in hot weather. There is little available data, however, as to the clinical value of such an arrangement. A combination of a mechanical refrigerating system with an indirect heating and ventilating system for cooling purposes is quite possible.

Recapitulating, the essential features of a hospital ventilating system may be said to be:

Ample natural or window ventilation.

Supplementary thereto an ample supply of fresh air at a low temperature to all rooms used by patients.

System of exhausting the vitiated air from all such rooms.

Special exhaust fan systems for toilets, baths, slop sink and mop closets, etc.

Separate exhaust fan systems for laundry, kitchens, machinery rooms, etc.

The operating rooms may well be separately treated.

Air intake should be located as high as possible.

All air supplied to the hospital should be freed from dust by means of filters, preferably of the washer type.

Air chambers and ducts should be finished smooth, and so far as possible be subjected to light.

Humidification is desirable, and even essential.

Temperature regulation is desirable and a source of economy.

Direct radiation, of a limited amount is regarded as desirable.

HOSPITAL LIGHTING

By E. H. BOSTOCK

IT is, of course, rather trite and commonplace to say that here is a subject to which, considering its importance, the architect has not given sufficient study, and yet if it is of the next greatest importance to sanitation in hospital building as it should rank, then it is about the most neglected subject; for the light problems of a hospital are rather peculiar, and cannot be met by the usual methods of simply providing enough windows or lighting outlets.

It is the unusual hospital that is located where it may obtain full and unrestricted light; rather, of necessity, are they in such locations in urban districts where light is cut off by surrounding buildings, by smoke or dust, and sometimes forfeited to avoid publicity. Every hospital, of necessity, carries lighting problems of its own.

In hospital lighting one great help, of course, is that it is the wise custom to keep all interiors finished in white enamel, almost altogether, thus giving about the best reflecting surface, and, while undoubtedly this has come to stay, if architects had before them the readings of light efficiency of rooms finished in white and in other colors, they would be glad of the greater efficiency shown as proving their wisdom.

Daylight lighting of hospitals is probably just now in a transitory period, inasmuch as, for the feeling of safety gained by its use, wire glass is being used as a means of fire protection. In hospitals in cities, probably before long, building codes will require its use, and in grouped or connected buildings it surely must be adopted, and if such a possibility is admitted to exist, then we had better plan to meet it.

One is apt to think of wire glass as the grade usually used in fireproofing warehouses, etc., forgetting that polished wire glass as clear as plate except for the mesh of the wire is procurable, and, if he knows of the latter, judges its price as being as high as when first introduced a few years ago. It is, however, very much lower in price recently, and can be used to great advantage in glazing.

It would seem that, in the case of a wing with windows on three faces, that ordinary rough wire glass would give all the desired light and fire protection at the least cost.

When rooms can only receive light from one exposure, however, or if overshadowed by buildings across the street to the exclusion of light, we must find a means to utilize all the available light flux and resort to polished wire or prismatic wire glass.

Prism glass and wire glass are of course known to architects generally, but possibly it is not known to all that a combination

of them—prismatic wire glass—has recently been marketed.

For use in locations facing streets or light wells the manufacturers make prism glass with different angles calculated to turn light into buildings at approximately a right angle, and by reference to their data the glass with correct angle to suit any situation may be procured, and a double sash window, the upper sash glazed with the proper prismatic wire glass, and the lower with polished wire, would seem appropriate, if cost permits.

It has become the custom of recent years to equip each hospital with a sun parlor. These usually are built upon the roof so as to catch all possible sun and light, and built with an insulating space sufficiently supplied with heat between the outer and inner glass, and are well planned for their purpose, but it occurs to the writer that advantage is not taken of an opportunity here in using the therapeutic qualities of light.

For instance, certain green and blue-toned lights are depressing in effect, and, on the contrary, some amber and rose tone lights are cheering. Now, in the treatment of certain forms of melancholia or those where low spirits retard convalescence, a corner of the sun parlor glazed with light amber (champagne) tinted glass would be of great value it would seem, in bringing back brighter spirits.

The sash could be made to fit the inner casing and movable, so that they could replace the clear glass at will, or even be changed for other glasses having known therapeutic values for the sunlight to bring out.

Wherever a hospital is fortunate enough to possess detached operating rooms, or rooms with skylights, advantage should be taken of this fact to procure light by having a dome constructed, not of ground glass as has been frequently done, but by a dome of the new diffusive glasses in sheet form.

In the question of artificial light the first inquiry is what shall be the medium, and it seems, too, that there can be only one answer, as electricity so nearly fills all our requirements. The question rather seems to be, is it worth while to use combination fixtures or pipe for gas at all?

It will, of course, be admitted that great danger ensues upon the use of gas in wards and operating rooms, first from the use of light fabrics and lints, and also from the dangers that slight leakages might have upon weak and susceptible patients.

Gas is, of course, impossible where sulphuric ether is handled largely, and in the days when chloroform was of more frequent use doctors remember vividly the acrid odor of burning chloroform vapors.

No electric plant, however, is infallible, and, as a matter of insurance against its failure, perhaps the majority of architects will think it wise to have the buildings fitted for gas, and provide the necessary gas outlets to tide over such a possibility.

Whatever fixtures may be provided should be of the simplest type, with no more ornamentation or angles to catch dust than can be avoided, utterly plain spinnings and tubing, if they can be used with an enamel finish that may be washed if necessary, without harm, are best.

The lights provided for halls, stairways and corridors should be as far as possible ceiling dishes, this being the form easiest kept clean, and the glass bowl, if to be used with a ground or acid finish to soften light, should be specified "ground or finished on the *inside*."

Wall brackets should be avoided if possible. They are harder to keep clean and sanitary, and there are known instances of patients turning on gas outlets and leaving them undiscovered for a long period.

The color values of light in relation to hospital work deserve a few words, for the nurse or surgeon must of necessity decide sometimes as to what is healthy or unhealthy tissue by its color, so that if its color value is changed very much from that of its daylight color they may be a little at fault. The yellow color of the carbon filament lamp, sometimes intensified by long use, can surely be improved on by the use of the tungsten filament, and, while we have considered other sources, we are inclined to advocate the more general use of the tungsten lamp as being the most practical white light that we can use, having in mind also its low cost per candlepower-hour.

The lighting of the hospital wards is one point on which it is hard to come to a decision, as there are so many factors to be considered: the color, the amount, the

localizing, the mobility of units, all seem to pull against each other.

The first thought arising probably is that some one of the concealed lighting schemes would be of great value, but after considering it in connection with other features, we fear it does not apply. Even if it were only a matter of enough light, the strain upon the eye

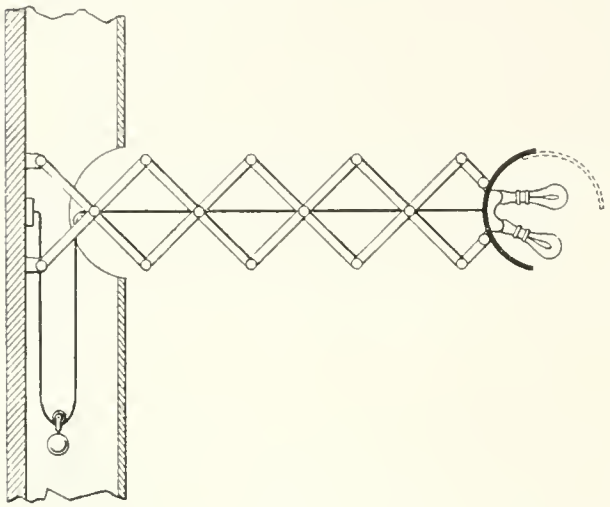


FIG. 1

of a patient who must for many hours keep the tension of the eye muscles set, by reason of the absence of restful variations of light, would cause its abandonment. Small candlepower units are often needed as night lights, and again high-powered lights are needed for some attentions that must be given and a plug and cord necessitating two nurses' care is surely a disadvantage. If a high-powered lamp is used under these conditions its light may annoy other patients unduly, and again it seems wise to arrange units that can be brought in use at any bed where needed as quickly as possible.

As a matter of general ward night lighting, the installing of two or three ceiling clusters with ground dishes is probably as good as can be done.

But for general purposes, after studying all conditions, perhaps a fixture built from the suggestion in the accompanying illustration might act as a guide.

If the "tongs" feature were not thought feasible, this might be replaced by telescopic tubes.

It is designed to carry an eight-candlepower carbon and a forty-candlepower tungsten light, and for ordinary use to fit into recess in wall as if it were a stationary sconce, and used with the eight-candlepower lamp as a night light or nurses' aid for general purposes.

When for examination or attention a good light is required, the light which would be installed over every bed is pulled out to any position where it will stay without attention, being tight-riveted in every joint of the extension tongs and the swivel joint with which it is fastened to the studding; the rider weight is used to keep wiring always in order. The shade used could be built double as shown in cut, and if light is to be used any length of time, the upper part be slid out to serve as a screen to keep light from annoying other patients; the shades would be of light sheet metal with white enamel finish, thereby acting as reflectors and when pushed back into wall as sconce being in touch with wall finish and almost unnoticeable.

While not really in topic, it would seem best to provide a push socket outlet below this in wall for use if electrically operated instruments may be used.

In operating rooms care must be taken to provide enough light in all portions of room so that nurses may never be at a loss in reading labels, etc., but the question of proper lighting for the operator is a matter of graver discussion.

The usual procedure has been to provide a cluster of carbon filament lamps of supposedly sufficient power at a height of about twenty-four inches above the level of operating table. The candlepower usually installed was from 120 to 200, and yet, while this would seem to be ample, surgeons are continually complaining as to light, and either require nurses to hold a portable light close to the point of operation or wearing a head lamp with a reflector to help them.

One mistake has been that, the light having usually been from a relatively small area, whenever the hand of the surgeon was interposed of necessity between the area of light source and the point of operation, a shadow was cast that was inconvenient.

Perhaps this question could best be solved by the use of a circular or rather hexagonal fixture built up of say six three-foot units of reflecting trough as shown, carrying lamps of forty-candlepower tung-

sten type fitted with a fluted glass reflector designed at angles to throw all the light within a circle of two feet diameter at the height of an operating table. This fixture

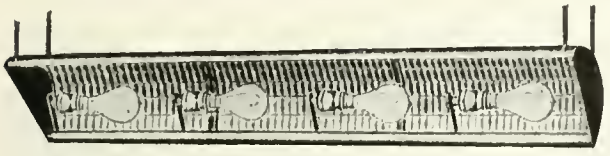


FIG. 2

might be hung at height completely out of way of surgeons, and yet throw easily two or three times the light available under present systems upon the work, and if diameter of circle be kept at about six feet the surgeon cannot create a shadow that will trouble him.

The color of light has also been considered in recommending tungsten lamps; the slow-starting lights might at times waste valuable seconds, and the tube lights might indeed by the breaking of a unit cause trouble; whereas the breaking of a filament lamp or two would in a circle of such lights be no great inconvenience.

In the matter of the lighting of clinical amphitheatres as attached to most hospitals we think a fixture of this type desirable, also, except that it had probably be better suspended by chain so as to give as few lines as possible to obstruct vision.

CONTAGIOUS GROUP OF THE PROVIDENCE CITY HOSPITAL

MESSRS. MARTIN & HALL, ARCHITECTS

THIS particular hospital is unique in construction and in its administration because it is probably the first hospital to be established in this country where contagious diseases are treated on the theory of contact infection, which means, when defined, that such diseases are not carried by the air but by something or somebody coming in contact with patients suffering from a disease and transmitting it to the healthy individual. Heretofore contagious diseases have usually been combated on the theory that diseases are carried by the air and it is only very recently that physicians and hospitals have begun to adopt the theories of Pasteur on the subject of contact infection. He established a ward in Paris, in which a variety of diseases were treated in the same building, under definite rules and requirements as to care on the part of nurses and others coming in contact with the patients, and secured definite results. Eighteen months of practice of these theories in the Providence City Hospital has indicated that they are sound.

The following extract from the report of Dr. Dennet L. Richardson, Superintendent, clearly explains the method employed in securing the very best results from the building as designed and planned.

"The opening year of the hospital has presented many problems. It has not been easy to bring together efficient help (for many of the employees had never had any previous hospital experience), and establish a routine based on the principles and practices of other hospitals and adapt them to our own needs. We have had to make changes and expect to make more to improve the service. The peculiar problems relate to the method by which we have started out to handle contagious diseases. It is based on the theory of contact infection, which, defined, means that these diseases are not carried by the air but by something or somebody which has come in contact by touch with a patient suffering from one disease and transferred it to the healthy individual. As a working basis, contact infection is made to include possible infection by coughing upon anything or anyone at short range. While perhaps this is the first time this practice has been employed in this country, it has been successful in certain hospitals in England, France and Germany.

In the treatment of all the contagious diseases contact infection is avoided by

GENERAL VIEW OF GROUP, PROVIDENCE CITY HOSPITAL, PROVIDENCE, R. I.

strict asepsis, and air infection has been disregarded. Nurses, orderlies, maids and all the help are carefully instructed, first, how to protect themselves, and, secondly, how to avoid transmitting infection from one ward to another, or from one patient to another. The following set of rules is given to everyone:

"Keep finger, pencils, pens, labels and everything out of your mouth.

"Keep and use your own drinking glass.

"Do not kiss a patient.

"Wash hands often and always before eating.

"Keep out of doors as much as possible and always sleep with your window open.

"Do not touch face or head after handling a patient until hands are washed.

"Do not allow patient to cough or sneeze in your face.

"Do not eat anything that patient may wish to give you.

"If taking a drink or lunch be sure and use the nurses' dishes.

"Put on gown or change uniform when going into the ward.

"On leaving ward always wash hands.

"Always remember that infectious diseases are carried by contact and not by air infection."

The nurses all occupy the same dormitory and eat in the same dining-room. When ready for duty they go to a dressing-room where they put on a ward uniform. Each nurse is provided with two lockers, one for her ward clothes and the other for the uniform worn when off duty. On leaving the ward she changes again, washes her face and hands and dries them on an individual towel.

The ward maids live with the other female help and eat in the help's dining-room. They observe the same rules as do the nurses, with the exception of wearing a long gown instead of removing the outer garments.

The resident physicians, when making their visits, wear white suits and put on a gown in each separate ward. This is not always done unless they are likely to examine patients. No caps are worn. Great care is taken in washing their hands.

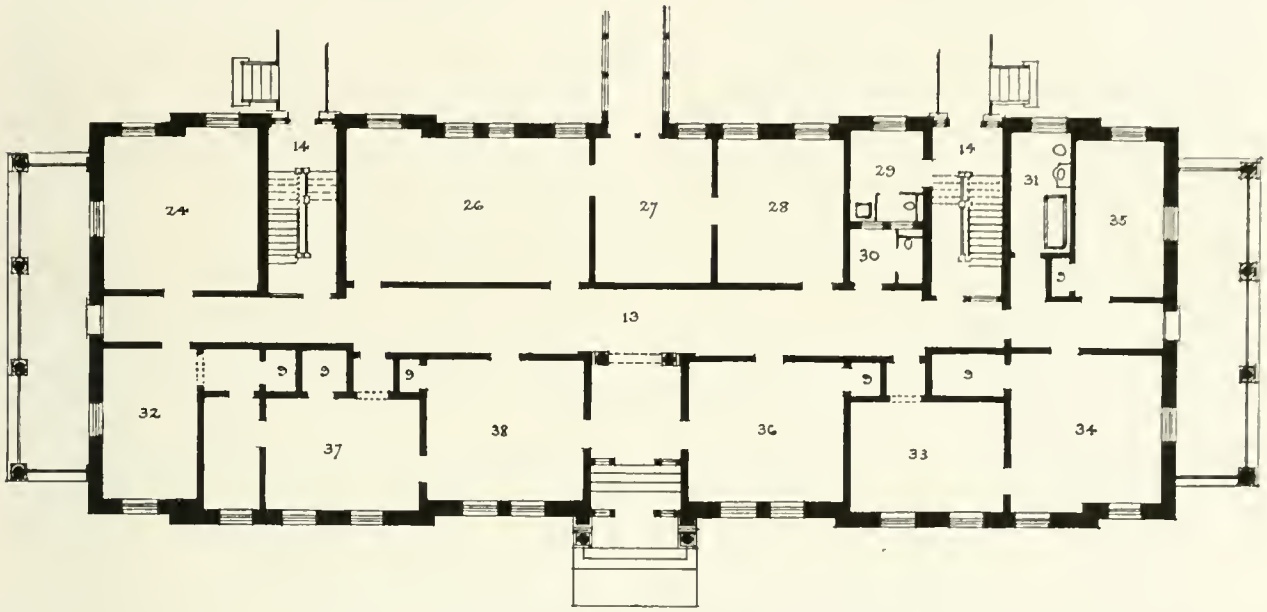
Soiled clothing is thrown down a chute and falls into canvas bags which are regularly collected. One man is delegated to take the clothing to the laundry, where it is put directly into the ordinary washers and washed in boiling water from forty to sixty minutes. The man wears a gown and washes his hands thoroughly after handling the infected clothing. The clean clothing is delivered to the wards in bundles tied up in cloth.

The number of dishes which must pass between the main kitchen and the ward kitchen has been reduced to a minimum, but such as do are carefully boiled. All garbage is burned.

I believe that the most fertile source of infection is the patient himself. It is very important to make a correct entrance diagnosis, to rule out mixed infections and if there is any doubt, to isolate the case until a decision is reached. New patients are taken to the admitting room in each ward, where they are carefully examined, the

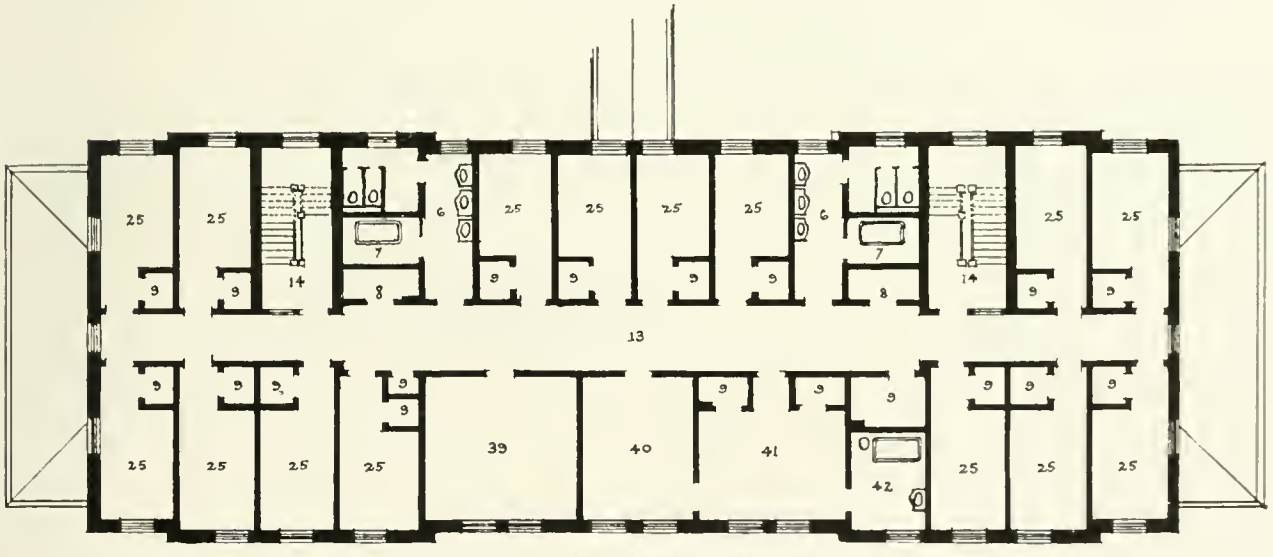
history and physician's examination carefully recorded and then are sent either to detention rooms, guarded by a red card if necessary, or sent to the isolation ward.

We have already found our isolation ward insufficient and have been obliged to isolate some mixed cases in the diphtheria and scarlet fever wards. To fulfil



FIRST FLOOR PLAN, ADMINISTRATION BUILDING

4. Room.
6. Lavatory.
7. Bath.
8. Linen Closet.
9. Closet.
13. Corridor.
14. Stair Hall.
23. Tunnel.
24. Sewing Room.
25. Chamber.
26. Nurses' Dining Room.
27. Serving Room.
28. Doctors' Dining Room.
29. Women's Lavatory.
30. Men's Lavatory.
31. Doctors' Bath.
32. Internes Chamber.
33. Superintendent's Parlor.
34. Superintendent's Living Room.
35. Superintendent's Chamber.
36. Superintendent's Office.
37. Matron's Office.
38. Waiting Room.
39. Nurses' Sitting Room.
40. Matron's Sitting Room.
41. Matron's Chamber.
42. Matron's Bath.
43. Nurses' Laundry.
44. Servants' Dining Room.
45. Pharmacy.
46. Trunk Room.



SECOND FLOOR PLAN, ADMINISTRATION BUILDING

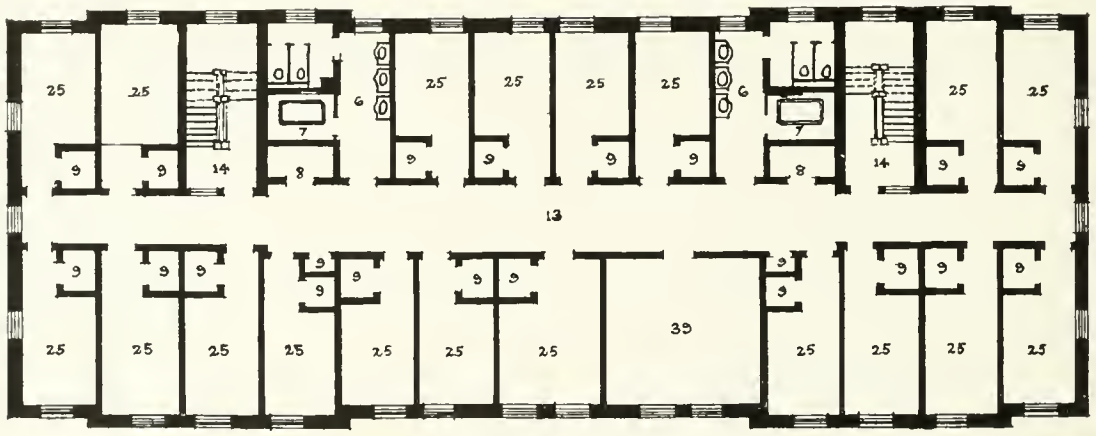
Even if the diagnosis seems plain, all patients are placed in detention rooms for several days, where they are meanwhile treated as suspicious cases.

the same purpose of the barrier system of the English, we hang on the bed, or put on the door, a red card on which is printed "Special Case." Hands are washed before

and after handling the patient and a gown is worn. Every such patient has his own bed pan, urinal, thermometer, and all his dishes are sterilized. Every patient has cultures on the first two days of his hospital residence, and one is taken in the admitting room before he comes in contact with any other patient. If the cultures are positive in any but the diphtheria wards, the case is isolated. Soap and water alone are used for cleaning hands, floors, walls and furniture. Mattresses are sterilized by steam. Rubber goods and glass goods are treated with carbolic acid 1-20. Fumigation is never done.

I wish now to speak of the results of the treatment of cases in the isolation ward, where are carried on the same precautions as will be used constantly and can be kept in the room as long as the patient occupies it. Utensils, dishes and trays after being taken from the room are put directly into a large utensil sterilizer in the ward kitchen and sterilized by steam and hot air before they are washed. The ward kitchen is thus kept uninfected, and the trays of food are made up and taken directly to the different rooms. All rubber goods, glassware, bed pans and urinals are sterilized in 1-20 carbolic solution.

Only physicians and nurses are allowed in these rooms. If they simply go in and do not touch anything in the room no precautions are taken. If the patient, or anything in the room is touched, the hands are washed with soap in running water and



THIRD FLOOR PLAN, ADMINISTRATION BUILDING (*See Key on Page 31*)

as are practised on the red card cases, but more effectively. On the first floor of the isolation building are ten rooms, five on each side of a common corridor. The doors are opposite to each other, and beside each and opening into the same room is a full window, so that a nurse may pass along the corridor and note what is going on in each room without entering the door. Each is provided with running water, controlled by levers, which are operated by the forearm, to avoid contact by hands. The furniture consists of a chair, a metal bed, and bedside table, so constructed that they can be easily and thoroughly cleansed. The patient once placed in a room is not allowed out of it unless taken out of doors, and seated by himself. He is provided with a thermometer, pus basin, hand basin, ice bag and so forth, such things dried on individual towels. If the patient is handled much or examined, gowns which hang in the rooms are put on. The care of the hands is rigidly insisted on. Toys, books, etc., are either sterilized or burned after the patient goes home. On discharge of a patient the bed and furniture, floors, door knobs, wash basin and walls within reach are washed with soap and water. Dirty clothing is sent to the laundry. The mattress is sterilized by steam. The room is aired as long as possible until there is another patient to occupy it.

The second story of the isolation ward, consisting of one, two and three-bedded rooms, has been provided with running water, sterilizer, etc., such as the first story is provided with. This was opened early in January, 1911, and we now have ample facilities for isolating twenty-five cases.

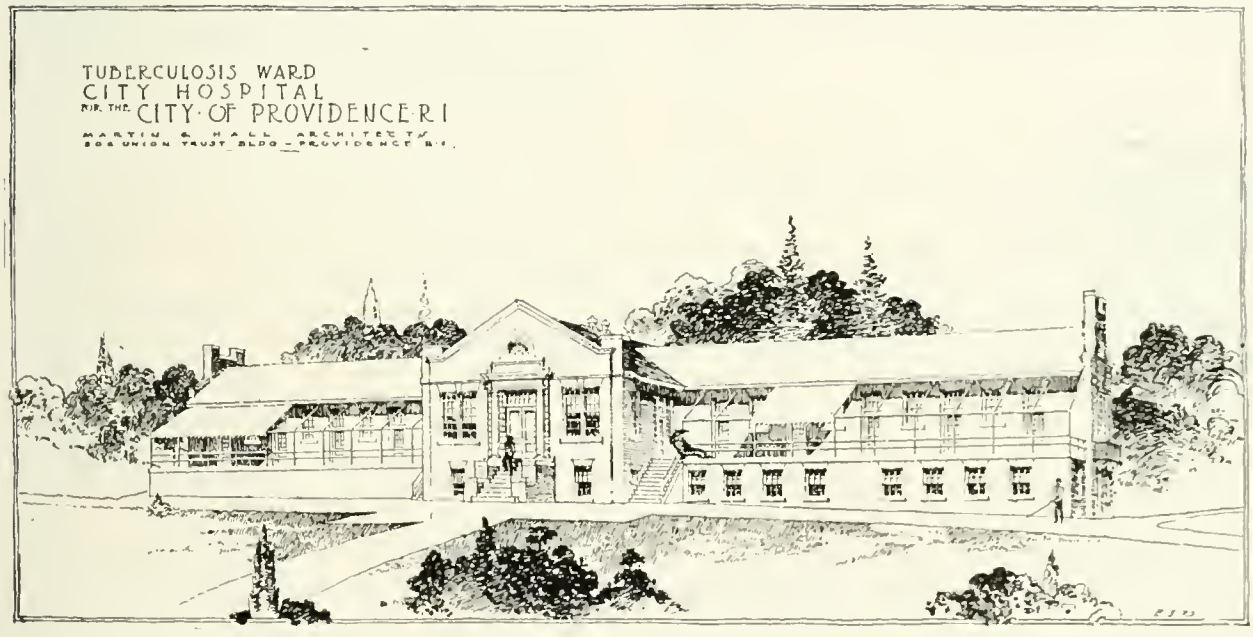
These aseptic principles are laborious and require thought and great care. Most of the credit and success of satisfactorily treating cases in this way belongs to the nursing force.

The doors are left wide open and the wind sweeps freely through the rooms in warm weather, when the windows are opened also.

From the opening of the hospital March 1st, to the close of the hospital year December 31st, there were treated in this ward 140 cases, representing 190 different diseases. These diseases were divided as follows:

Scarlet Fever	38
Diphtheria	18
Measles	38
Chicken-pox	6
Whooping Cough	29
Mumps	5
Positive Diphtheria Cultures	21
Gonorrheal Vaginitis	7
Rubella	2
Erysipelas	1
Non-contagious Diseases	25
Total	190

At all times there have been varying combinations of the above diseases in the ward at the same time. When there are only a few cases of chicken-pox, measles and whooping cough, they are put directly into this ward and kept there until discharged, because it saves on nursing force and it has seemed safe to treat them there. One case of measles and one case of chicken-pox have developed among the 140 persons treated in this ward, although they are practically in the same ward, and nurses pass from one to another, observing the necessary precautions. No case of cross infection has arisen in eight months.



HOSPITAL BUILDING, BROOKLYN CHILDREN'S AID SOCIETY SEASIDE HOME, CONEY ISLAND, N. Y.

MR. EDWARD PEARCE CASEY, ARCHITECT

SEASIDE HOSPITAL OF THE BROOKLYN CHILDREN'S AID SOCIETY, SURF AVE., CONEY ISLAND, N. Y.

EDWARD PEARCE CASEY, ARCHITECT

THIS hospital is an extension of the former plant of the Society, consisting of a number of frame buildings and cottages fronting upon the beach, and is intended primarily in its planning for the treatment of young children during the summer months.

The site is an entire block located back of the present group, and was, at the time operations were begun, in its primitive condition of drifting sand dunes, ten or twelve feet high, of fine white beach sand, which afforded, of course, an excellent foundation for the walls of the structure.

The hospital comprises the main building, some 200 feet in each direction, and a detached laundry building in the rear.

In these two buildings are found practically all the elements of the modern hospital establishment; wards and separate rooms for patients; the administration, including central reception room, with adjacent waiting room, doctor's office, head nurse's office and drug room, and in the rear of these the general dining room, nurses' dining room, kitchen, pantry and store room. There is also an operating room with dependencies and equipment in the way of various kinds of sterilizers, etc. A milk laboratory wheret he milk for infants is prepared, bottled and subsequently distributed to the various diet kitchens is also centrally located. At either extremity of the building, on both floors, are groups of dependencies, each consisting of a diet kitchen, a general lavatory and bath, an irrigating room, fitted with sinks and slabs for the treatment of infants, and a linen closet.

A small pathological room is provided with facilities for research in disease, as well as a morgue room in an isolated position in the basement.

Accommodations are afforded for a total of 120 children, including those for sixty children accompanied by their mothers, each of whom occupies a separate room.

These rooms have doors opening upon the balconies, as well as upon the interior corridors, and are furnished with beds provided with small cradles, swinging from

davits at the foot for the convenient accommodation of the child. There are besides four small wards containing seven cribs each, and two larger wards each with sixteen cribs arranged in two rows down the center of the ward.

In the second story of the rear wing the nurses are quartered in sixteen separate rooms, while in the second story of the laundry building the various employees are quartered in eleven rooms.

The open court of the building at the front faces the south. The projecting wings

A CORNER OF FRONT COURT, HOSPITAL BUILDING, BROOKLYN CHILDREN'S AID SOCIETY SEASIDE HOME, CONEY ISLAND, N. Y.

MR. EDWARD PEARCE CASEY, ARCHITECT

on either side of this court are occupied mainly by the small rooms and small wards for the infant patients and their mothers.

These wings are entirely surrounded on three sides with covered balconies on both floors. Doors from the rooms open directly upon the balconies and afford ready means for the expeditious removal of patients for open air treatment.

The plan of the hospital has been arranged with a view to the provision of the greatest amount of air and thorough circulation.

The main corridor running across the building at the front may be opened up in the warm weather so as to make it virtually an open air balcony, similar to those surrounding the wings. Besides, all corridors terminate in either window or door openings in the outside walls, while short cross corridors are provided in the wings, all as an additional inducement to the interior circulation.

The flat roof over the whole building,

LOOKING ACROSS FRONT COURT, HOSPITAL BUILDING, BROOKLYN CHILDREN'S AID SOCIETY SEASIDE HOME, CONEY ISLAND, N. Y.

MR. EDWARD PEARCE CASEY, ARCHITECT

approached as it is by the main staircase, also affords opportunity for open air treatment under favorable conditions of the weather.

All openings are fitted with casement sash or doors, as the case may be, with transom sash overhead in every instance, thereby affording means of utilizing the entire area of the opening for the passage of air, or of modifying it to any desired amount.

The space between the roof and the ceiling of the second story affords a non-conducting air protection against the heat of summer, and the cold of winter, and for

LOOKING INTO FRONT COURT, HOSPITAL BUILDING, BROOKLYN CHILDREN'S AID SOCIETY SEASIDE HOME, CONEY ISLAND, N. Y.

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the purpose of renewing the air as it becomes heated in summer, numerous small openings are placed in the walls under the cornice. These openings are provided with

WING, CONTAINING SMALL ROOMS AND WARDS, HOSPITAL BUILDING, BROOKLYN CHILDREN'S AID SOCIETY SEASIDE HOME, CONEY ISLAND, N. Y.

MR. EDWARD PEARCE CASEY, ARCHITCT

movable louvres, which serve to prevent the escape of such heat as this air may contain during the cold weather.

The space under the floor of the first story is also provided with louvred openings to admit of a proper regulation of the air under the building.

A complete circulating steam plant is installed, which will allow operation of the hospital throughout the entire year, although this is not at present contemplated. The boiler is located in a cellar under the kitchen and is of cast iron sectional type.

The radiators are direct and are located under the window openings in order, as is usual, to counteract the natural cold currents at these points.

A high pressure boiler is also provided to furnish steam for use in the operation of the laundry, as well as to provide steam for sterilizers in the operating department and in the milk laboratory, and also for cooking apparatus in the kitchen.

Electricity is employed for all lighting, as well as for operating the laundry machinery and for ironing.

Gas is introduced simply to supply small cookers in the diet kitchens, and as an auxiliary in the main kitchen, and to supply sterilizers in the operating rooms and doctor's office.

The construction of this plant is interesting mainly as affording an example of fireproof hospital construction at a remarkably low cost, as this amounted to sixteen cents per cubic foot, including laundry machinery and all apparatus of a fixed nature, excepting sterilizers.

The construction to the level of the first floor is in gravel and Portland cement concrete. The outer walls of the first story balconies are supported on concrete arches between piers of the same material, the arches being concealed below the grade line.

The cellar under the kitchen, which contains the boilers, water heater and coal storage, was placed with some difficulty about four feet below the water level in the fine shifting beach sand. The cellar bottom was made very heavy of concrete mixed with waterproofing compound, and heavily reinforced with the tension bars near the top of the slab, in order to resist the upward pressure of the ground water.

The outside walls, including the roof parapet walls, are constructed of heavy interlocking terra-cotta tiles, affording within the wall sufficient inclosed air spaces to insure a dry and non-conducting wall without the use of furring on the interior surface.

The balcony piers and arches are constructed of brick.

All interior partitions are of terra-cotta tile of various thicknesses.

The first floor, including the floor of the balconies, is entirely of reinforced concrete, of beam and slab construction, while the second floor, including the balconies, is a combination of reinforced concrete beams filled between with terra-cotta blocks. This latter method of construction produces a flat ceiling, without resorting to the ex-

MAIN TRANSVERSE CORRIDOR, HOSPITAL BUILDING, BROOKLYN CHILDREN'S AID SOCIETY SEASIDE HOME CONEY ISLAND, N. Y

MR. EDWARD PEARCE CASEY, ARCHITECT

pense of furring, and thereby does away with the numerous surfaces and angles produced by a beam ceiling, which tend to the collection of dust and cobwebs.

The stairs are likewise constructed of reinforced concrete and are finished with slate treads, and otherwise with the same hard finish that is applied to the walls.

Trim is used only in the openings of thin interior partitions, and this is of as simple and non-dust-collecting character as possible.

The window openings are without trim, with the wall plaster rounded in to meet the frames.

In fact, all angles of the plaster work, both salient and re-entrant, are rounded, as well as the angles between the floors and the walls, which are finished with a Portland cement base made flush with the finished wall surfaces.

A COVERED BALCONY, HOSPITAL BUILDING, BROOKLYN CHILDREN'S AID SOCIETY SEASIDE HOME, CONEY ISLAND, N. Y.

MR. EDWARD PEARCE CASEY, ARCHITECT

By these means all surfaces and parts of the interior are readily accessible to cleaning processes, so essential in a hospital, and also are less liable to accumulate dirt.

An interesting feature of the construction is the outside trim, comprising the base course, water table, main cornice, sills, caps and steps. It was intended to form these in concrete, but in order to avoid the imperfections inherent in monolithic concrete formed in place, such as flaws, holes and a general rough appearance, it was decided to cast all this work in separate pieces on the ground, when any imperfect casting could be rejected. This was done, and besides all exposed surfaces of the blocks were finished on a rubbing bed to make them more presentable. No attempt was made to imitate any particular variety of stone, but the result obtained seems to be fully as satisfactory, both in hardness and appearance, as some of the varieties of limestone, while at the same time the cost is very much less.

This idea of finishing concrete in the same obvious ways that stone is finished is one that is seldom practised, but surely one material is as capable as the other of being thus rendered more presentable.

The exterior surfaces of the terra cotta walls and of the brick piers and arches surrounding the balconies, and also of the concrete and terra cotta ceiling of the first story balcony, are stuccoed in Portland cement mortar applied in two coats. The finishing coat was done with a rich mixture of white Portland cement combined with coarse white sand, which gave a very hard, but rough sand finish.

More or less difficulty was experienced in getting the men to sufficiently impregnate the walls with water, and otherwise to keep the stucco damp until thoroughly set, but damp weather was a great aid, and very little hair cracking is apparent.

Experiments were made with the fine white beach sand, of which there was an unlimited supply, but the result with an equally rich mixture was very unsatisfactory as the cement did not properly set and the stucco could be rubbed off as powder.

The floor covering for the balconies, as well as the main corridors, operating room and milk laboratory, is made in granolithic pavement, with metal mesh imbedded in the foundation to prevent cracking, as the customary joints between sections were eliminated in order to secure the unbroken surfaces so desirable in modern hospital architectural practice.

THE ARTIFICIAL LIGHTING OF HOSPITALS

Abstract of a Paper read at the Congress of the Royal Sanitary Institute at Belfast, by Mr. John Darch

NY one who has had insight into the work of modern hospitals could not do otherwise than feel the greatest admiration for the splendid service and effective equipment that characterize those institutions; and yet it must be said that, models of elegance and hygienic forethought as they are, their excellence is usually marred by the engrafting thereon of systems of artificial lighting that would justify a repetition of Miss Nightingale's trenchant observation that "the very first requirement in a hospital is that it should do the sick no harm."

Light (and in that term radiation both visible and invisible must be included), like any other form of power, may become an agent of destruction or a minister of health and blessing precisely in accordance with the wisdom shown in its application; and it is the duty of the professional adviser, be he architect or engineer, to understand all that pertains thereto before he can pretend to satisfactorily invest his buildings with the instruments of such a force.

There are to be avoided, on the one hand, the evils of glare, and particularly that which, in a ward patient, would enter the lower part of the eye; the evils of excessive brilliancy, of violent contrasts of light and shade, and of the injurious and troublesome rays of heat and actinism; there is also to be avoided the risk of eye strain consequent upon insufficient light or upon the effort to see in the face of misplaced lights. On the other hand, there is to be sought the comfort of a soft and well-diffused light so arranged that vision may be both easy and pleasant, which, after all, is the proper object of lighting.

The value of illumination depends not on the amount of light that is shed throughout a room, but on that which is reflected from visible objects. An essential part, therefore, of any scheme of illumination is the coloring of walls and ceilings, the strength of which must be properly balanced with the amount of light available. Dark colors eat up the light, and are, therefore, wasteful. White ceilings, cornices and friezes not glossy, with pale tinted walls and slightly darker dados, will best serve the hospital and its inmates.

Let us proceed to consider some practical methods of dealing with the subject, and begin with

The Hospital Ward

The average ward unit—of, say, twenty beds—should be provided with two kinds of illumination, viz. (1) general, and (2) local.

1. The general lighting need be no more than enough to see clearly about the room, say, 0.5 foot-candle.

No sources of light, nor any illuminated surfaces exceeding 0.1 candle-power per square inch (14 candle-power per square foot) should be exposed to the patients' or nurses' eyes; whereas the intrinsic brilliancy of the

Gas mantle averages..	30 c.p. per sq. in.
Acetylene flame.....	40 " " " "
Electric carbon filament.....	400 " " " "
Electric metallic filament.....	1,000 " " " "

Direct illumination, therefore, useful enough in the lofty outpatients' hall or elsewhere, is quite unsuited to the hospital ward.

Direct lighting lamps may, however, be used if provided with proper shades, but everything depends upon that word "proper." Glass shades and all transparencies are inadmissible, nor should any partial translucency exceed the above-named limit of brightness, while any shade that is used should effectually screen the eyes without materially darkening the room. If bracket lights be used for general light-

WARD IN HOSPITAL BUILDING

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ing, a half circle shade should be used so as to illuminate the wall. The practical result of all this is a soft all-over illumination which is very pleasing.

High placed ceiling lights will prove equally successful with a carefully calculated shading.

Indirect lighting by means of the inverted electric arc is deservedly gaining favor, but although it would serve well in many parts of a hospital, I could not recommend it for the ward, as the ceiling would be too dazzling for those who have to lie on their backs.

A happy effect may, however, be obtained from indirect lighting, with tungsten or other metallic filament lamps, placed inside a shallow metal bowl, white on the inside. To obtain the best effect they should be hung as low as convenient, nor should the lamp be set too low in the bowl.

Excepting in the winter, artificial lighting is little needed in the ward, for hospital economy favors very early hours, but some sort of subdued lighting is necessary during the night watch all the year round. With gas or acetylene a small burner, shaded, on a by-pass would do. In electric lighting, several expedients have been adopted, but a 2 candle-power shaded lamp is the most economical. An excellent arrangement is indirect lighting from an 8 candle-power lamp in a small bowl.

2. *Local Lighting.* The sisters' and nurses' tables should each have a well-shaded lamp, that is adjustable in height, so that any desired intensity may be obtained. A comfortable illumination for reading is 4 foot-candles, but 10 foot-candles is not too much for some purposes. A good form of shade is a deep cone of dark green opal, with the lamp entirely recessed. A more cheerful form would be one with a rose silk flounce with white lining, deep enough to hide the lamp, and for cleanliness the top should be of white opal glass, and the flounce easily removable.

The patients' lights are best placed one at the head of each bed, hidden in a dark green opal shade and somewhat to the left,

so as not to radiate heat on the patient's head and to avoid gloss in reading. An illumination of four candle-feet should be available. This lamp will be useful for examination, and should illumine the patient's chart. Near this there should be a plug for a hand or standard lamp.

Steadiness is an essential condition of good sanitary illumination, for fluctuation and flicker are not only very disturbing, but may amount to permanent injury. This trouble may arise (*a*) from the glow lamp when used on an alternating current whose frequencies are below, say, 35 per second; (*b*) from an arc lamp when the light varies in intensity and color, due to unsuitable or impure carbons, or when it "pumps," due to defective feed mechanism; (*c*) from the gas mantle, due to an ill-regulated air supply, accumulated condensation in pipes or the wind from the open windows of the ward; and (*d*) from all flame burners by the two last-mentioned causes.

Gloss is frequently as troublesome as bare lights, and yet the majority of hospital wards have shiny ceilings. There should be no difficulty in getting a diffusive or dead surface as sanitary as that of the objectionable gloss.

The Operating Theatre

The operating theatre needs good artificial light, and plenty of it, for there is a large proportion of surgical work done after dark. It should have a separate general illumination with screened lamps over the sinks and sterilizers. The ceilings and walls should be completely reflective, and are best lined with close-jointed white glazed tiles, with a little relief in the form of a pale green or grey dado.

The illumination of the operating table is, of course, the leading consideration. The light should approximate to the color, the perfect diffusion and the high intensity of broad daylight; both the nuisance of overhead heat and the septic risks of dust collection should be avoided, and the fittings and glass employed should be plain, smooth and easily cleansable.

It is important that the lights should not all be clustered together, forming deep and troublesome shadows, nor be situated directly over the table to worry the surgeon with the shadows of his own head and hands, or that would necessitate the frequent shifting of the table. Yet these are the arrangements most commonly met with.

Every hospital has its own pattern of operating light (scarcely two are alike), while many of them are very curiously contrived. The following may be taken as typical of the more usual arrangements:—

1. One or more plain shade pendants of the common type, sometimes with a dust-raising counterweight and pulley.

2. A cluster of from two to twenty glow lamps under a large opal shade.

3. Rectangular trough four feet long with opal sides, full of lamps, and sometimes with a sheet of opal glass underneath; this gives an excellent light, but the heat is intolerable.

4. A four or six light electrolier, each arm with a separate lamp and opal or aluminum bell shades.

Either of the foregoing may depend from the ceiling or from the end of long swing brackets. Glow lamps should have metallic filaments; tungsten is said to give the whitest light. Gas burners are sometimes attached.

At Charing Cross the drawback of concentration is well met by distributing the light over the long arms of four brackets and round the gallery front.

The London Hospital and that at Ryde are fitted with operating light, consisting of a fixed central 100 candle-power lamp under an opal reflector, with four hinged arms, each with a 60 candle-power Nernst lamp in a condenser tube projecting the light to any desired spot.

Electric arc lamps are employed in some continental theatres.

Direct lighting with ordinary arc lamps is out of the question on account of the unavoidable shadows; excepting, perhaps, for general lighting. But where there is a large skylight a splendid direct illumination may be obtained from white flame arc lamps, which have a remarkably high efficiency, and throw most of their light downwards. Four of these may be suspended over, but not too close to, the ceiling light, which should be of clear fluted glass to spread the light. They may be fixed, or may move on rollers worked by cords in the

room. Questions of dust and the intrusion of lamp trimmers are thus eliminated.

Indirect arc lighting, particularly where there is no skylight, is eminently suitable. Four ten-ampere open arcs, properly placed and reflecting directly against a white ceiling, would give a brilliant illumination, with all the advantages of daylight.

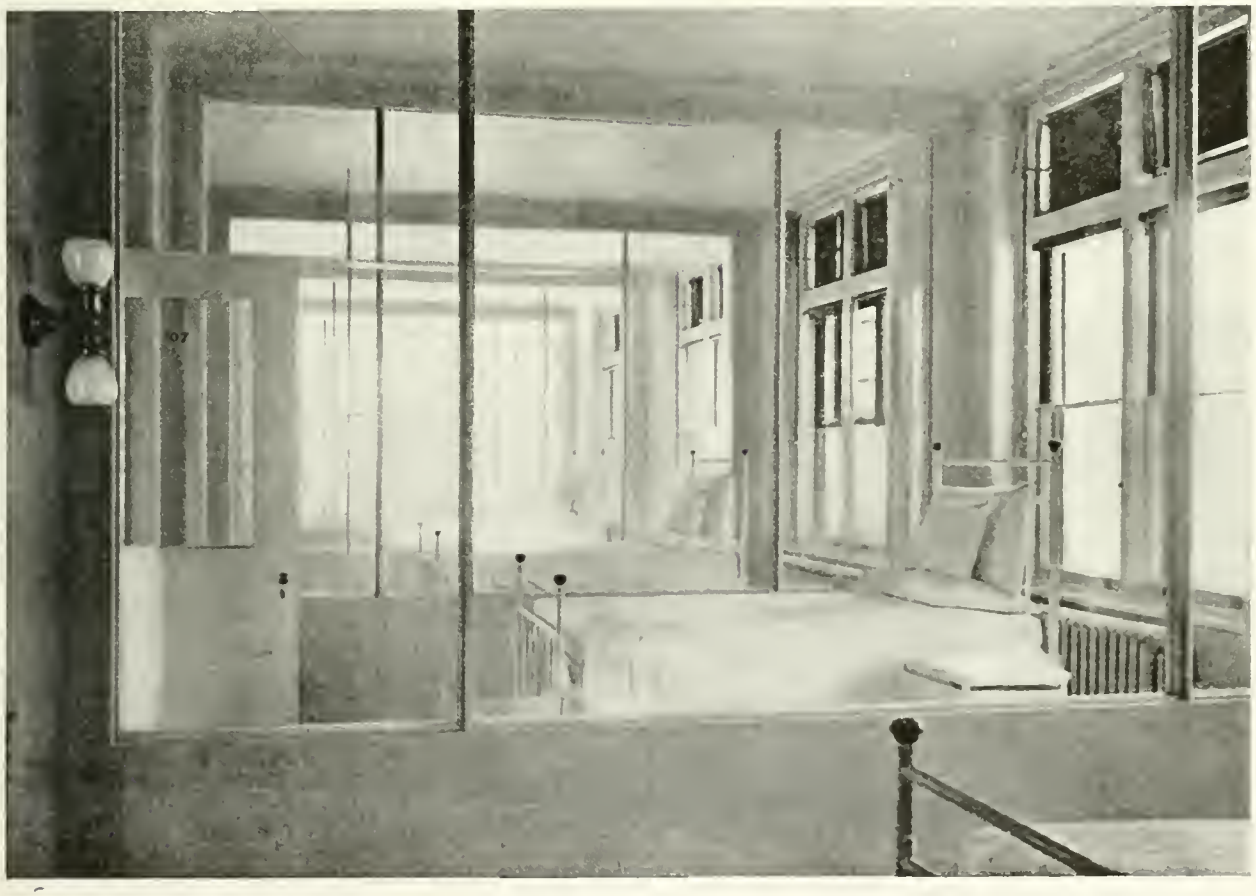
Professor Siedentopf has invented an ingenious arrangement for lighting the operating table by means of isolated beams of light, which are not only ample but entirely avoid the dust question.

There are two forms of it:—

1. The single, in which a twenty-ampere projector, or search light, is placed outside the theatre, and about seven feet six inches high, from which a parallel beam of light is directed through a hole to a small mirror, thence to the table, or through a second mirror to the table. This beam is controlled by an iris diaphragm and smoked glass. It is best suited to the gynecological and throat theatres. It is necessary to have good general lighting.

2. The compound form is more satisfactory. A projector lamp as before, but of twenty-five to thirty amperes, directs the light through an aperture to a thin metal disc, on which are placed small distributing mirrors which divide the main beam into a number of smaller ones, and which are separately projected to receiving mirrors placed around the room. These mirrors reunite the light on the table in a many-sided form, free from shadows.

Electric fuse wires have a knack of "going" at most inopportune moments, while a breakdown on the part of a supply company is not unknown. It is, therefore, essential to have a reserve for such an emergency. The fusing trouble is more common on branch circuits; one excellent precaution, therefore, will be found in wiring glow



WARD IN ISOLATION BUILDING

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lamp fittings from two separate main branches, either of which failing, enough light may be left to work by.

To provide against failures on the main there are two methods:—

1. A gas lamp with an inverted mantle, as at the West London Hospital, which should be lit during operations.

2. An electric accumulator, from which a small emergency lamp should be kept alight during operations, and in connection with which it should be possible to immediately switch on sufficient light from the accumulator to complete an operation. Separate lamps would be required for this purpose unless it would be convenient to have the voltage of the accumulator equal to that of the circuit.

Some hospitals keep oil lamps ready to hand.

Hand and standard electric lamps of a variety of patterns are to be found in every operating theatre.

The Dispensary

is usually the worst served of any department. It is, in London, frequently to be found in the basement or in some other part of the building lacking daylight, while the artificial illumination is commonly so inadequate that it sometimes becomes a difficulty and a worry to read the prescriptions.

A properly shaded light yielding four or five foot candles is required to each man on the dispensing benches. The shelves should be illuminated with screened lights to facilitate visual acuity; in fact, no bare lights should be visible. Undoubtedly, the inverted arc lamp with a white ceiling would afford the best illumination, while the running cost of it should compare favorably with that of glow lamps.

Nothing is more productive of eye strain than the effort to decipher any kind of graduated scale, but with the faint lines of a glass measure in the twilight of the average dispensary held up to a patchwork background of bottles the strain is increased. It would save time and afford comfort if small white screens were fitted up, one in front of each man, adjusted to catch the chief incident rays from a skylight or window at such an angle that they reflected towards the dispenser. The same screen could be used under an artificial light or in a permanently dark situation, or there should be an illuminated panel of either reflected or transmitted light.

ST. VINCENT'S HOSPITAL, INDIANAPOLIS, IND.

MESSRS. D. A. BOHLEN & SONS, ARCHITECTS

THIS building is located in the center of a large park-like square, well relieved with trees and shrubbery, overlooking Fall Creek and its boulevards. It is accessible from four sides, being bounded by the most prominent drives of the city. The location is ideal and lends itself admirably to the quiet and restful beauty so desirable as a background for an institution of this character.

The building is designed to be fireproof and as sanitary as modern means of construction will allow. The exterior is of dark pressed brick, grading from a heavy, somber color on the first floor to a lighter and more lively one above, the whole being relieved with a rather free usage of Indiana limestone. The floor construction is of reinforced concrete slabs bearing on outside and inside brick walls; these walls being designed heavy enough to practically eliminate all noises from penetrating into the rooms. Throughout the entire building, sanitary base, made flush with the plastering, is used, and all ceilings and wall corners are coved. Wood floors are to be used in the rooms and terrazzo floors and wainscoting in the corridors and operating suites. All doors are flush panel, inlaid veneer doors, and the hardware, etc., is designed as simple as possible to avoid even the smallest lodging for dust.

Special attention has been paid to the arrangement of rooms. The northwest wing being designed entirely for the permanent attendants of the institution. The basement of this part being cold storage rooms; first floor, kitchen and serving rooms; main floor, Sisters' dining rooms and community room; second floor, Sisters' apartments; third floor, nurses' apartments. The north or chapel wing contains wards for nervous patients on the first floor, administration offices on the main floor, and the chapel and gallery on the level of the second floor. The south, west, east and center wings are devoted to wards and semi-private rooms on the first floor and private rooms on the main, second, third and fourth floors. Entirely over the main building and completely isolated from any of the other parts of the building are the operating rooms, with their necessary etherizing, sterilizing, *x*-ray and rest rooms. This floor also contains laboratories for analyses, crematory, scrub rooms and rest rooms for physicians and nurses. There are also emergency operating suites scattered throughout the buildings, which are designed just as completely as those on the operating floor. The roof garden extends over the entire building and affords a delightfully quiet place for patients to enjoy the fresh air.

The building is equipped with large sterilizing stills, so that all the water, both hot and cold, used on the operating floor and such other places as are deemed necessary, is distilled. The building is automatically and mechanically heated and ventilated. Each room being equipped with large outlet flues from which the foul air is drawn, thus changing the air throughout the entire building every few minutes. All of the plumbing fixtures are of the latest approved types of hospital fixtures and throughout the operating suites foot and knee action fixtures are to be used.

In conjunction with the hospital building proper, a large power house and laundry is being erected. This building is two stories high and is divided into a boiler room, in which three 150 horsepower Fitzgibbons high-pressure boilers are installed; engine room and laundry, including the necessary washing room, dryers, ironing rooms, etc.

HAYNES CONTAGIOUS BUILDING, BRIGHTON, MASS.

MESSRS. KENDALL, TAYLOR & STEVENS, ARCHITECTS

CO-OPERATION IN HOSPITAL PLANNING

By M. E. McCALMONT, R.N., Hospital Specialist and Consultant, Former Supt. Civil Hospital, Manila, P. I. Chief, Division of Hospital Construction and Equipment, Bureau of Health, Philippine Islands.

N this practical age the ultimate test of every proposition is, not so much what does it cost; is it the newest thing; or what do the critics and others think of it; but how does it work; is it practical; does it stand for the essentials of efficiency and economy of service?

And this is the working test to which our modern hospital planning and construction must be submitted. The architects are giving us smooth interiors and artistic exteriors. Many of them are becoming indeed expert on the subject of rounded corners and angles, flush surfaces and a general absence of projections, and yet we feel that these institutions are not yet all that might be desired.

That "the hospital is for the patient" has become an axiom beyond dispute. But no hospital is successfully constructed for the benefit of the patient unless *also* constructed for the comfort and convenience of the entire working personnel. No patient is receiving fair play from a hospital which has faulty working machinery; where jars, breakdowns and confusion are liable daily.

In view of this, the question is pertinent—*are our hospitals practical from a working standpoint?*

Who is to answer this, the architects, trustees and doctors, or the superintendents, and working staffs?

The architect may be an excellent judge of the durability of the latest flooring, and competent to pass upon all the technical details of hospital construction and finish, but can we expect him to know the details of hospital management sufficiently to cope with its peculiar and practical needs?

The trustees or boards of managers may be able to see that a hospital is clean and quiet, and be able to recognize, in practice, smoothly running hospital machinery, or its opposite—but can they, from their casual visits to the hospital, be in a position to locate an inconvenience of arrangement which may be the occasion of daily confusion?

The doctors, through visits to their patients, may know whether orders are being carried out or not; whether patients are improving; or whether they are satisfied with their surroundings and treatment. But if their patients are uncomplaining, can they know that a lack of improvement may be due to sleepless nights caused by noisy, banging doors; crying babies who should always be in sound-proof rooms; the too near proximity of utility rooms, bath-rooms or diet kitchens? Can they know that their patients are getting cold meals because a diet kitchen is not adapted or planned for efficient service; that a complaint of lack of attention may not be because there are not enough attendants, but because very often hospital planning necessitates an unwarranted expenditure of time and effort in the way of service?

These persons, doctors, trustees and architects, are obviously not in a position to fully appreciate all the working needs of a hospital for the simple reason that, usually, they have never worked in one. Yet they are the persons upon whom we must depend for the planning of our hospitals. Where there has been co-operation good results are generally noticeable, but very seldom is a superintendent seriously consulted in matters concerning which often he or she alone knows. Yet this same superintendent will be expected to find a way out of the difficulty after the error is committed and the building completed. Rarely, if ever, are the various heads of departments called in for an expression of opinion concerning subjects upon which they are sure to have practical, if not technical, knowledge.

Never has the writer known of hospital plans being submitted to the student nursing body for suggestion and discussion.

Yet it is almost certain such a procedure would draw forth many excellent suggestions. I am confident that fewer diet kitchens with their inevitable noise would be placed next to the wards, as is so often done, if nurses or superintendents were consulted about the arrangement. I am also sure they would ask for a reasonable number of sound-proof isolation rooms with properly guarded windows. Theirs is the personal responsibility for delirious patients, and such a request would have to be heeded. Yet, lamentably, few of such rooms exist!

Would it not be as well to ask a dietist what is to go into her diet kitchen, and plan accordingly, rather than label a four-walled room "diet kitchen" and attempt to place the manifold necessities there after the building is completed? It would seem that such lack of co-operation is largely responsible for a not unusual arrangement of gas stove and ice-box side by side, with a necessary serving table or drain-board for the sink omitted altogether for want of room. Who but the dietist would be liable to think of the convenience of having her meat blocks placed near the cold storage, and her kitchen so arranged that food trucks might be expeditiously loaded without disturbing the personnel or working machinery of the kitchen itself?

Can not the pharmacist best tell us of arrangements which would facilitate his work; of the most convenient relation of sinks, working tables, tablet machines, dispensing counters, etc., etc.? Would it not be better to allow him a voice in such matters, rather than have them arbitrarily arranged by persons who could not be expected to have a working knowledge of the facts, and, incidentally, would never have to suffer from the inconvenience and annoyance which follow a thoughtless arrangement or choice of equipment and facilities?

If a superintendent of nurses were consulted in the matter of a nurses' home, is it not probable that night nurses would be provided with sound-proof rooms located in a section of the building farthest removed from dining rooms, lecture rooms, baths, etc.?

The doctors always have adequate dressing rooms, lockers, shower baths, etc., in an operating pavilion, while a similar provision is seldom if ever made for nurses. Yet nurses may be perspiring through two or three operations to the doctor's one, and would have even greater appreciation of a proper dressing room and shower than he. If the chief operating room nurse were asked for suggestions in the planning of an operating pavilion, is it not probable that she would ask that these things be provided for her staff as well as for the doctors? Also, would she not protest against having her instrument cases placed in the sterilizing room, as is so often done? Would not her supply room be much more convenient and accessible than the usual *last space to be utilized* which is labelled "supplies," and then left to its sad and unsatisfactory fate?

The foregoing errors and many similar ones are actually found in the plans of some of our best hospitals. They are not necessary, and it is believed that a friendly co-operation between architects and heads of hospitals and heads of the various departments of the hospitals would see fewer and fewer committed. Such co-operation would undoubtedly develop a most wholesome esprit de corps among hospital trustees, officials and employees. *All* would then be working for the completion of an institution both beautiful and serviceable; intelligent in detail; and adapted in its every requirement to the great purpose of efficiently caring for the world's afflicted.

Does it not seem worth the experiment?

A TROPICAL HOSPITAL ADAPTABLE FOR TUBERCULOSIS

By M. E. McCALMONT, Hospital Specialist and Consultant

N every tropical country, there are certain peculiar and apparently insurmountable problems which confront those whose duty it is to provide hospital care and accommodation for the sick natives, foreigners and government employees. Class distinctions and race prejudices are encountered from the start and must be handled delicately or the ensuing friction will bring the working machinery to a halt at most inopportune times.

Probably every hospital built in a tropical country must needs be general in character—that is, must be ready to take care of medical, surgical and obstetrical cases, with provision for isolation in case of an unexpected communicable affection. Generally the officers, employees and nurses' training school have to be accommodated and suitably provided for. Sexes and races have to be separated, making at the least four distinct wards with well separated toilets, lavatories, etc. To include these manifold needs in one building and for a minimum amount of money is a problem which has vexed many of those who have cast their lot in tropical countries to battle with the numerous health and sanitary problems to be found there.

The plan which is shown accompanying this article is the result of experience and of a great deal of thought given to the subject by the writer.

"Thorough ventilation" has been the slogan, and has been accomplished by the ward wings with three exposures and the interior open court, which should of course be provided with a constantly playing fountain to cool the air in the heat of the day. The chief value of the plan is its adaptability and elasticity. The many divisions can be adapted to peculiar local conditions found any place in the tropics, while the general arrangement can be retained though the structure be built in varying capacities and according to varying appropriations.

The wards can be enlarged with increased funds without disturbing the administrative section.

Sexes and races are easily separated. The capacity of the hospital is practically doubled by removing the convalescents to the upstair roofs where they should require little or no nursing attention and where they are out of the depressing atmosphere of the acutely sick.

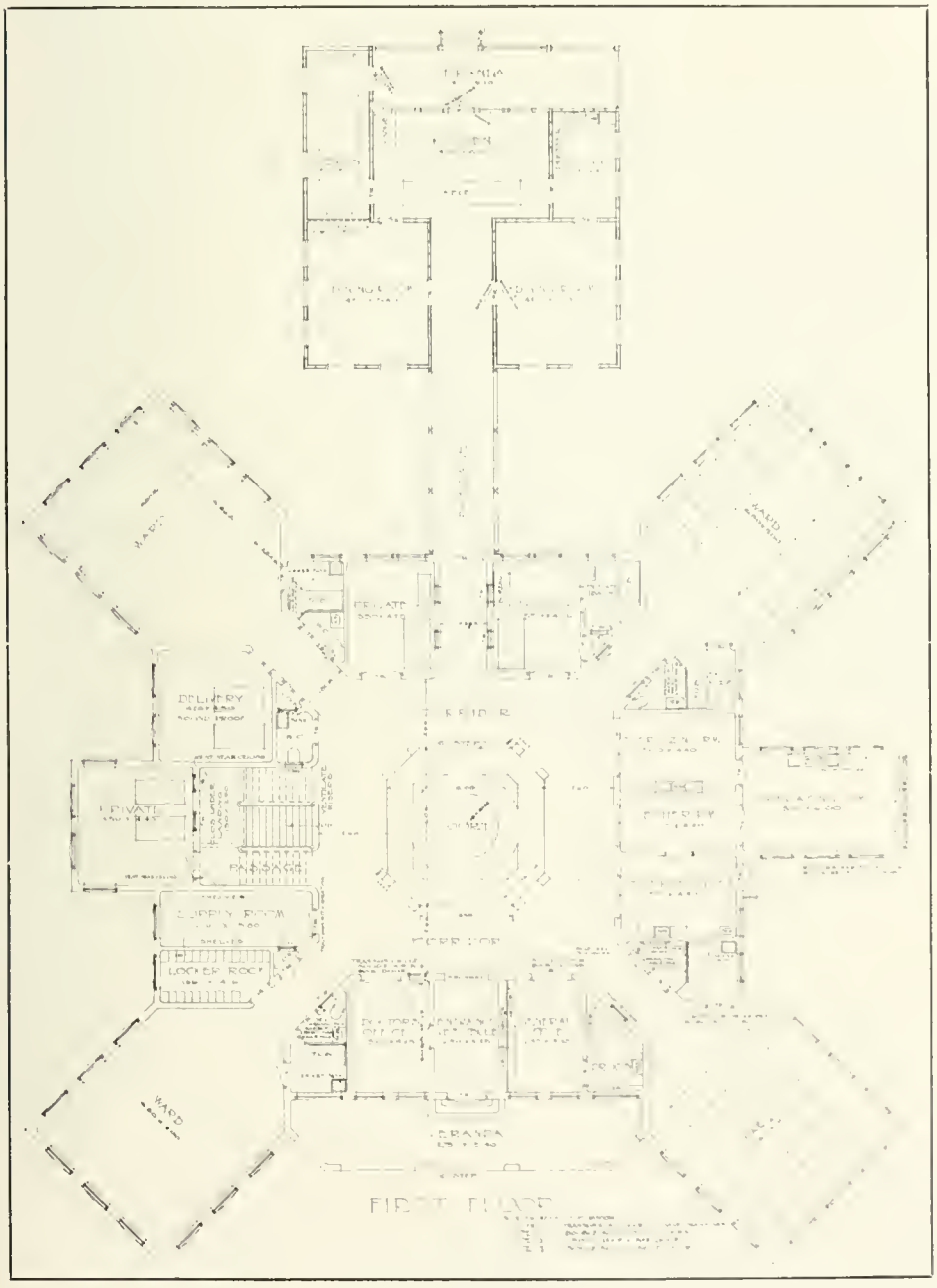
Native training schools for both young

FRONT ELEVATION

TROPICAL HOSPITAL

men and women are being started in almost every tropical country. The plan shown provides a dormitory for both. If the training school includes only women, one dormitory may be used for the extra male attendants, which, in such event, would be necessary. Nurses, pupils, and employees all have separate roofs for open air sleeping, a practice which is being more and more encouraged, and which in fact plays an important part in every educational health campaign. For hundreds of years certain superstitions and fears have kept native houses tightly closed at night, to which fact may be largely attributed the wide prevalence of tuberculosis in the Philippines and in other similar tropical countries.

The capacity for employees may be enlarged by putting a second story over the kitchen pavilion, but this is not desirable as the kitchen proper should be two stories in height, to make it bearable during the hottest season. A better arrangement would be to build a third inexpensive building which could be utilized for a laundry, tool house, disinfecting plant, incinerator, etc., and which could also include accommodations for any servants not provided for in the main building.



TROPICAL HOSPITAL

This hospital in the dimensions shown was planned as a reinforced concrete structure, estimated to cost (with a large proportion, though not all of its equipment) $60,000. Labor conditions, etc., vary to such an extent that it is impossible to make a more accurate estimate applicable to other sections.

If a larger sum is available and greater capacity desired, the plan is easily expanded by adding an extra room on each side of the central administration section and increasing the length and breadth of the wards accordingly.

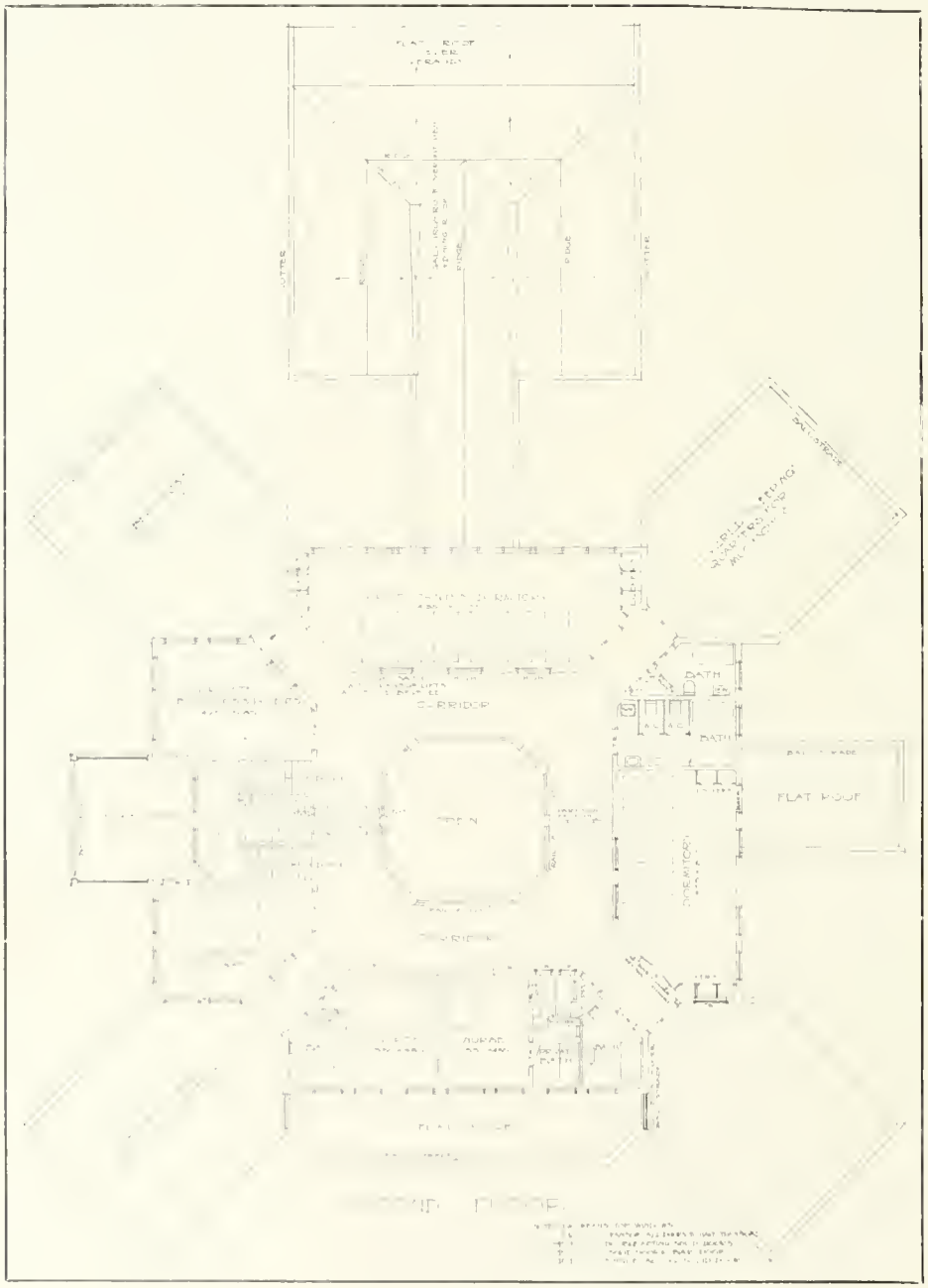
For convenience and economy of administration the

value of the arrangement is evident. So concentrated is this feature that the minimum amount of labor from a small staff will take care of a large number of patients.

AS A TUBERCULOSIS HOSPITAL

A tropical hospital for general purposes and a tuberculosis hospital for a temperate region have two great points in common. Heating of the wards does not have to be considered and plenty of air is the chief concern. For these two reasons alone, the plan shown is very adaptable for cases of tuberculosis. Certain changes may be made, as suggested, though local needs may necessitate even different modifications. Airy wards, warm dressing rooms and a maximum amount of sunlight are demanded in the construction of a tuberculosis hospital. It does not seem possible to get more sunlight for *all* wards than by the arrangement shown in the accompanying plans.

The convalescents can be moved upstairs to the roofs, which may be covered with awning or enclosed by glass. If a larger hospital is desired, a third story can be added with practically the same arrangement of wards and rooms, or if private rooms are more desirable than wards the wings could be broken up into private rooms.



TROPICAL HOSPITAL

As a tuberculosis hospital, only the administrative center would require heat and for such a hospital in a cold climate the central court would probably have to be domed instead of being left open. A large glass skylight which could be opened in summer might be feasible and desirable.

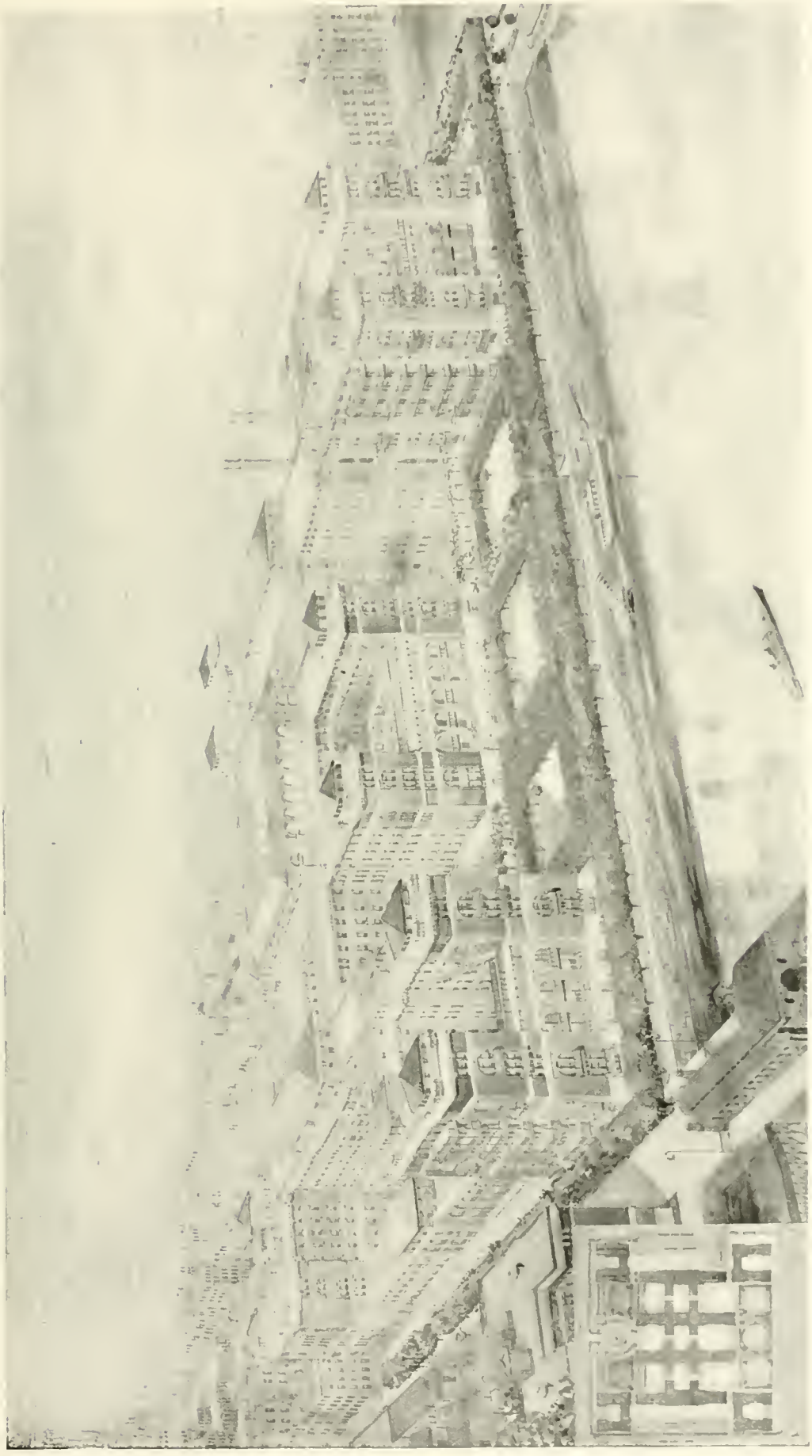
Details of construction of course provide for rounded corners and angles, smooth surfaces, and a general absence of projections. In addition to the regular doors the rooms are provided with the so-called bar-room doors which allow ventilation day and

night, yet sufficiently screen the view for ordinary purposes. Everything possible in the way of stationary equipment is built off the floors, or in other words, suspended from the walls.

The plan is commended to the hospital world for the unequaled amount of air and sunlight to all sections, and for the arrangement which represents minimum service with maximum results.

MODERN HOSPITALS

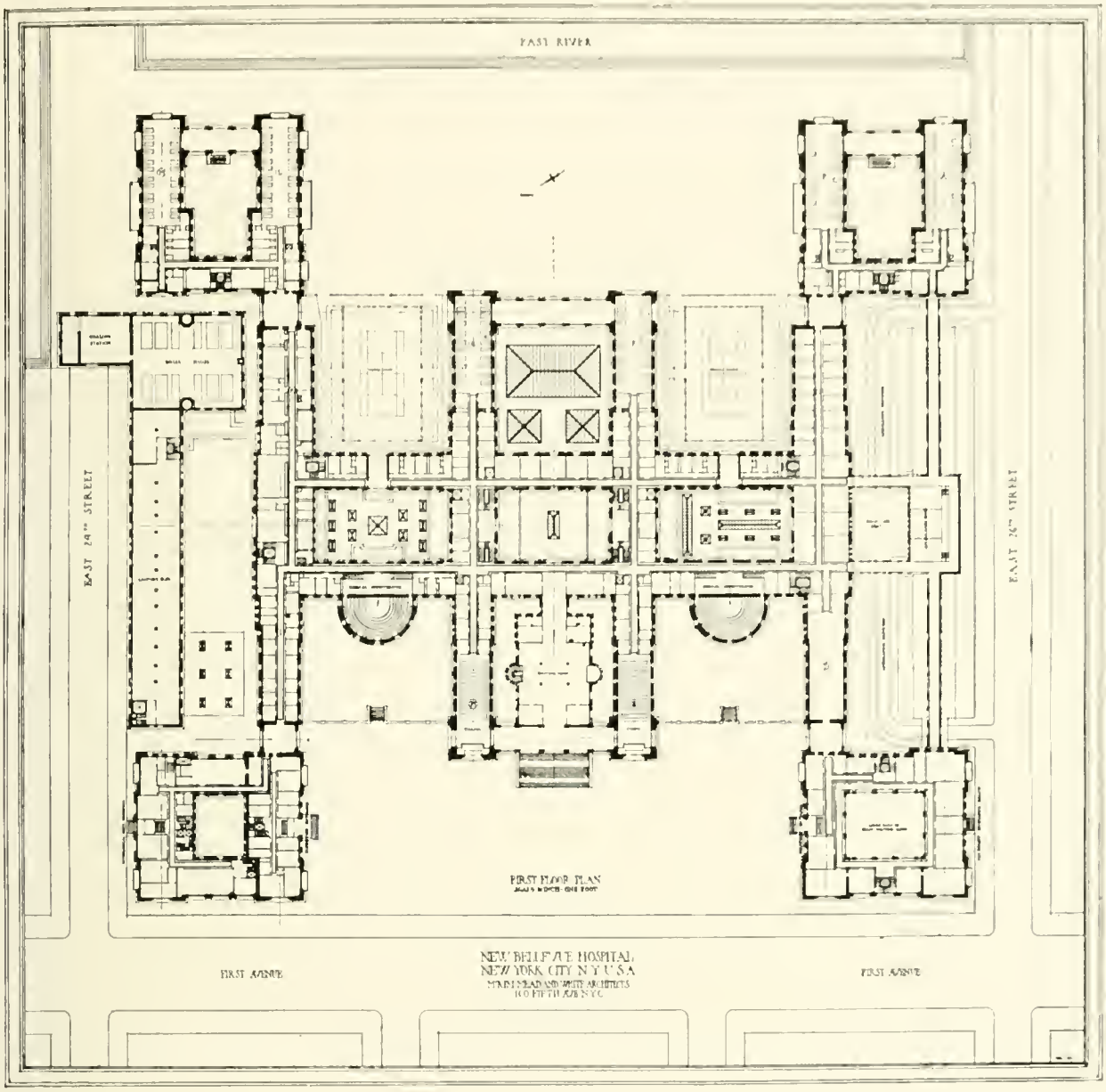
PLATES



THE NEW BELLEVUE HOSPITAL, NEW YORK

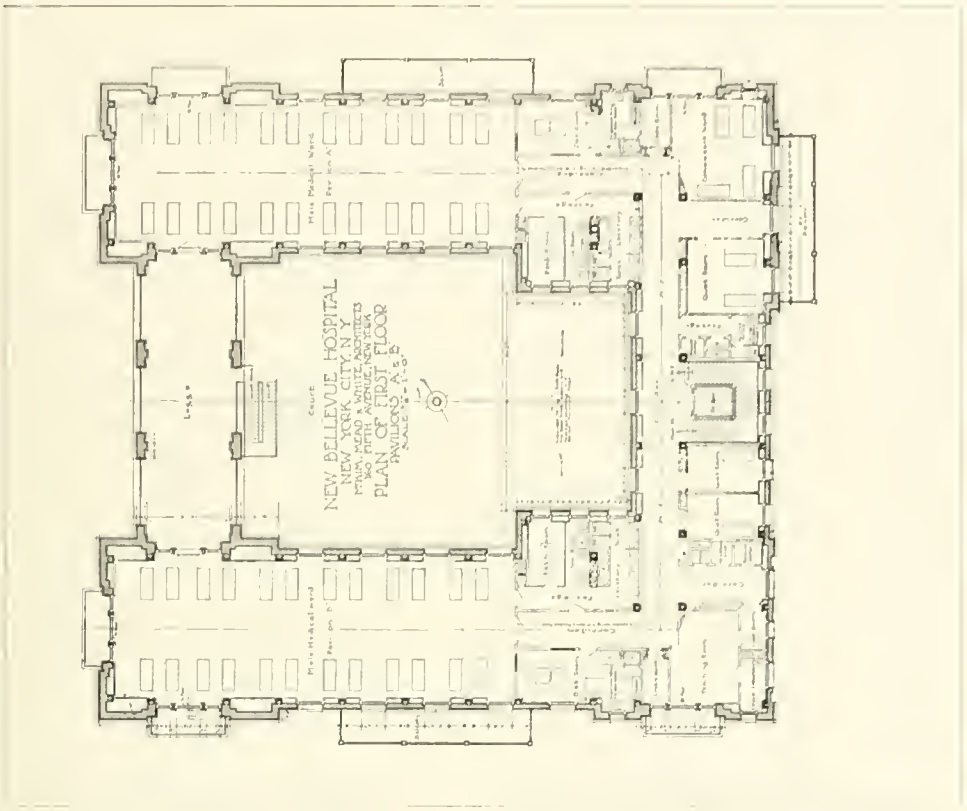
MESSRS. MC KIM, MEAD & WHITE, ARCHITECTS

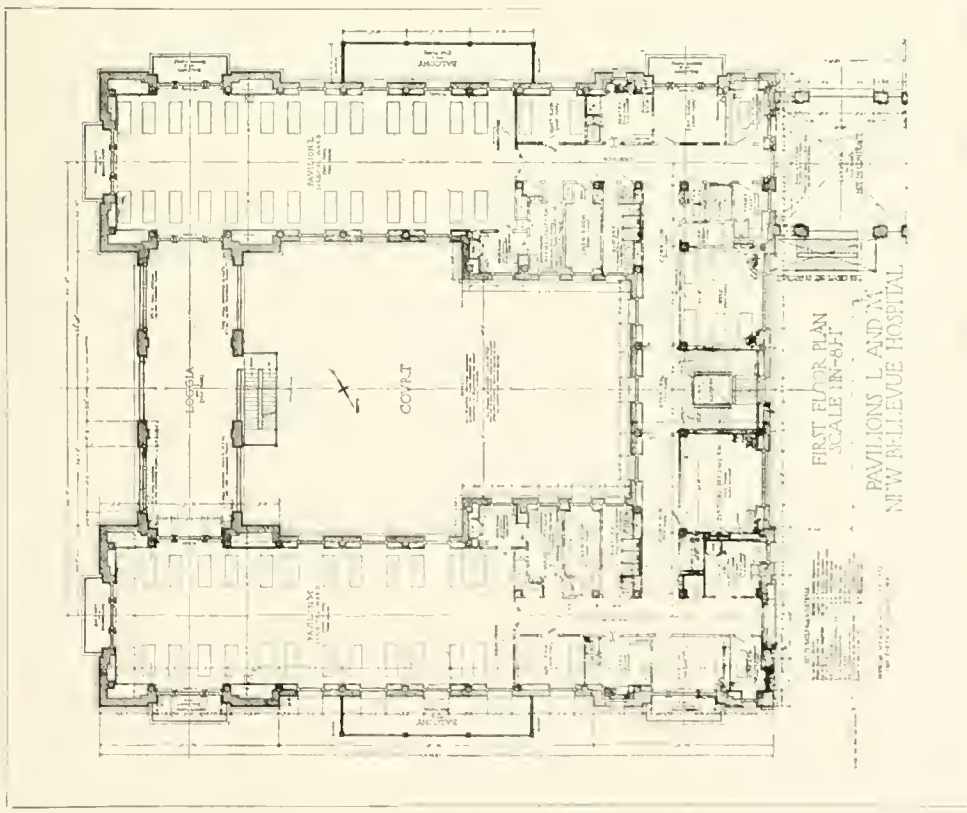
PLATE 1



THE NEW BELLEVUE HOSPITAL, NEW YORK

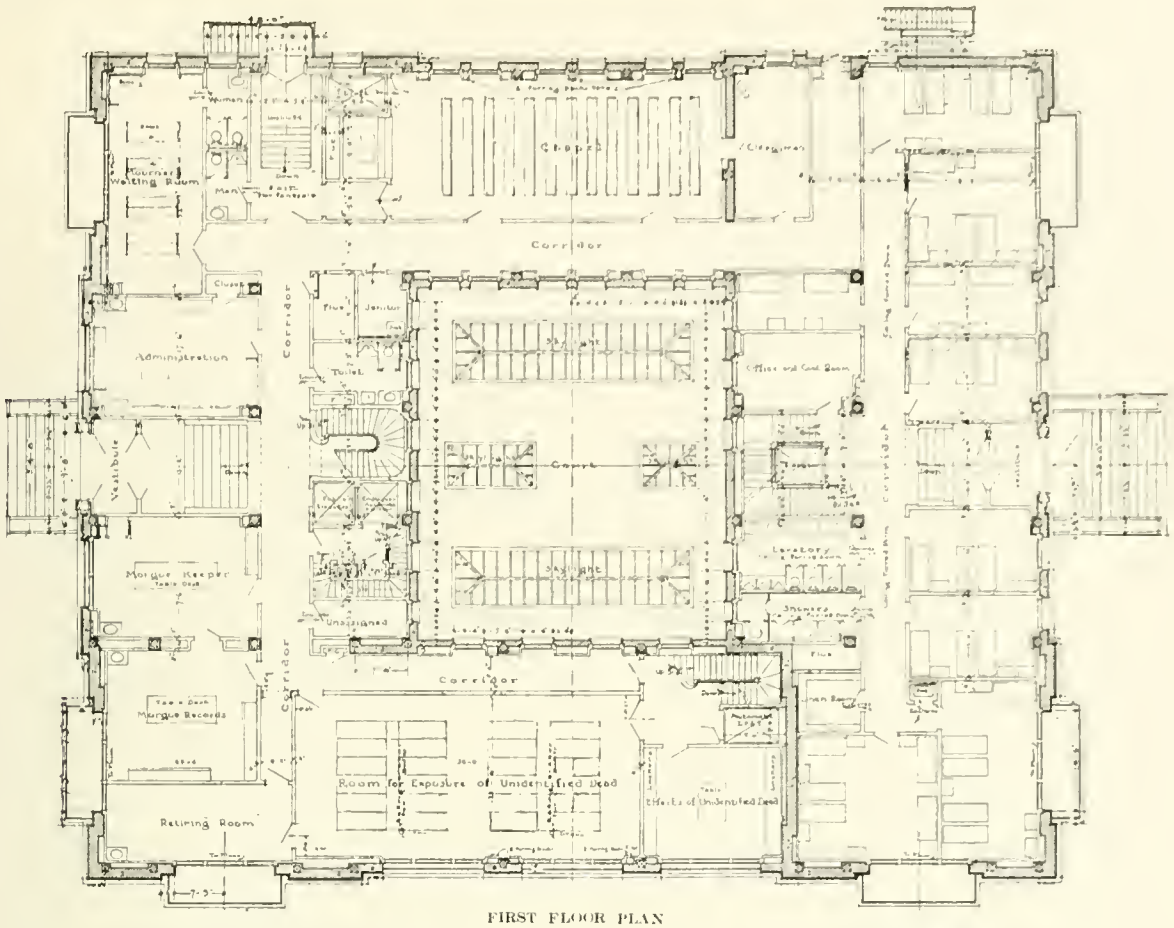
MESSRS. MC KIM, MEAD & WHITE, ARCHITECTS



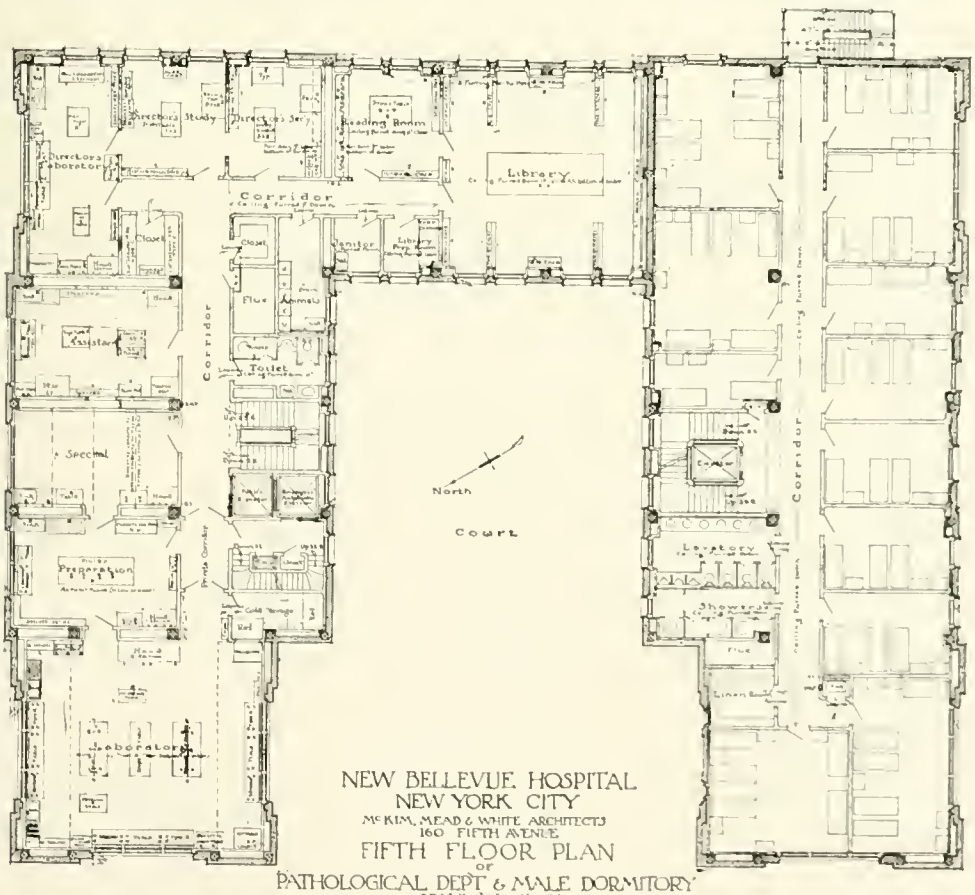


THE NEW BELLEVUE HOSPITAL, NEW YORK

MESSRS. MC KIM, MEAD & WHITE, ARCHITECTS



FIRST FLOOR PLAN



NEW BELLEVUE HOSPITAL
NEW YORK CITY
McKIM, MEAD & WHITE, ARCHITECTS
160 FIFTH AVENUE
FIFTH FLOOR PLAN
OF
PATHOLOGICAL DEPT & MALE DORMITORY
SCALE 1/8" = 1'-0"

PLATE 4

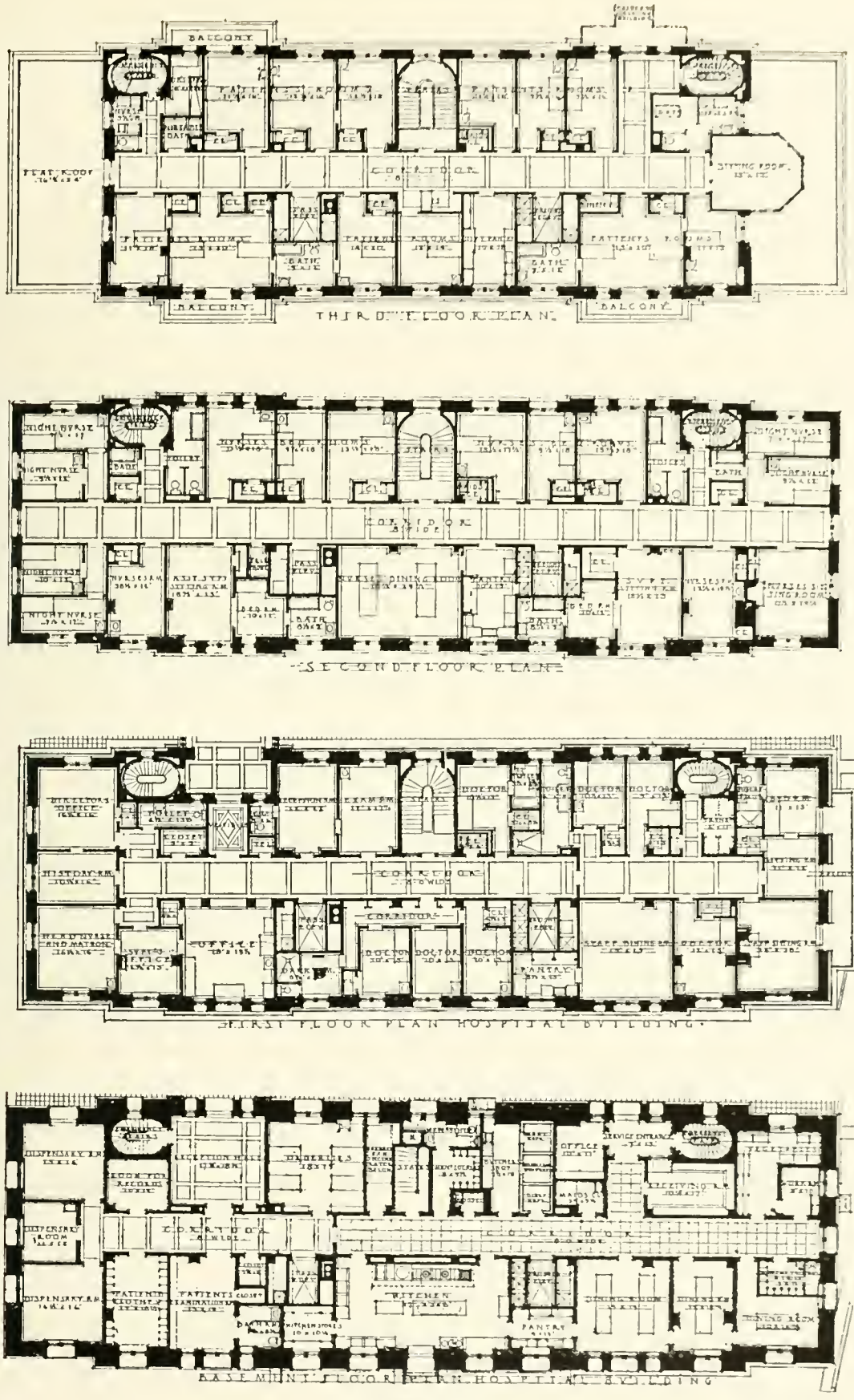
AT RIGHT—ISOLATION BUILDING AT FOOT—HOSPITAL BUILDING
MESSRS. YORK & SAWYER, ARCHITECTS

IN CENTRE—LABORATORY BUILDING
MESSRS. SHEPLEY, RUTAN & COOLIDGE, ARCHITECTS

THE ROCKEFELLER INSTITUTE FOR MEDICAL RESEARCH, NEW YORK

THE ROCKEFELLER INSTITUTE FOR MEDICAL RESEARCH, NEW YORK

At top is a general view showing the three buildings constituting the group. At left is the laboratory building, of which Messrs. Shepley, Rutan & Coolidge were the architects. In the centre is the isolation building, and at the right the hospital building. These two buildings were designed by Messrs. York & Sawyer, architects. At left is a picturesque view of the hospital building, with a glimpse of the isolation building. This view is taken from the East River.

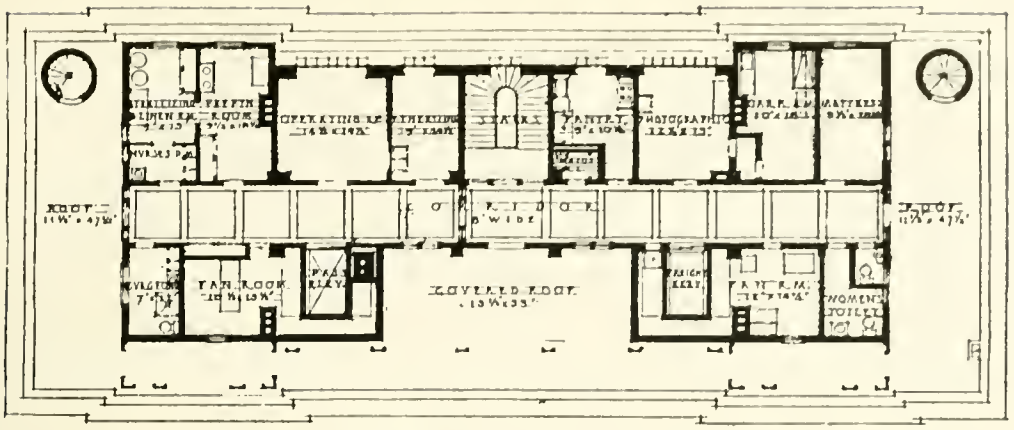


HOSPITAL BUILDING

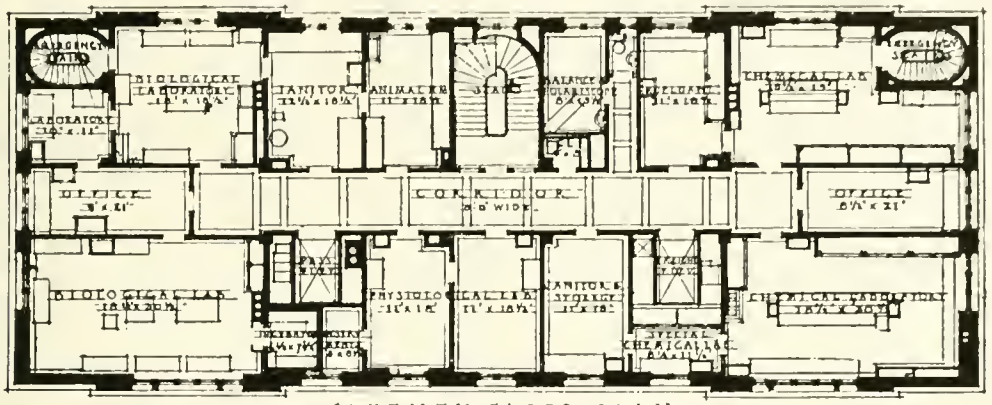
THE ROCKEFELLER INSTITUTE FOR MEDICAL RESEARCH, NEW YORK

MESSRS. YORK & SAWYER ARCHITECTS

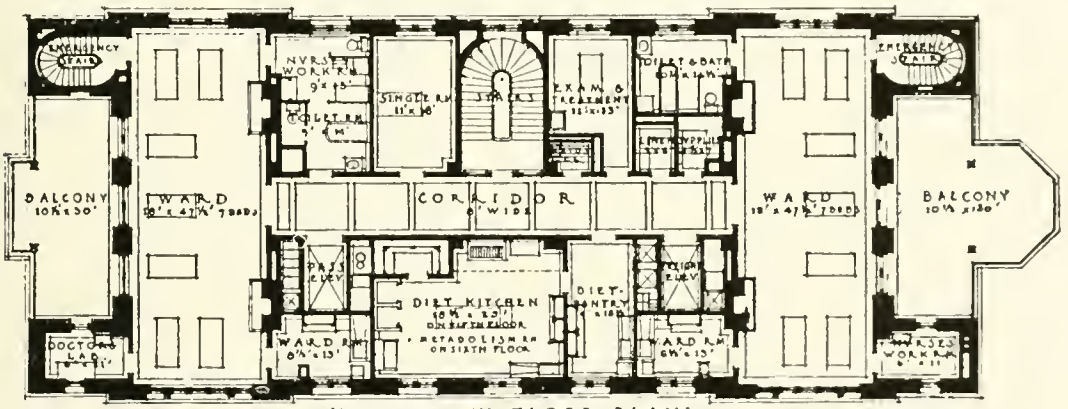
PLATE 7



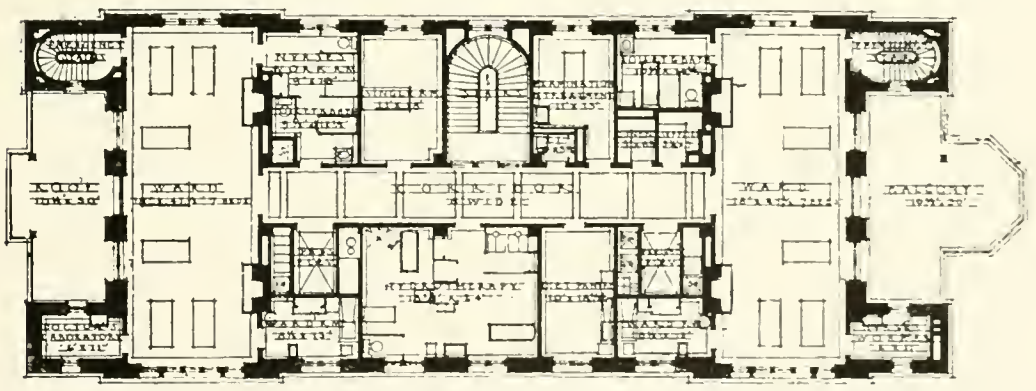
EIGHTH FLOOR PLAN



SEVENTH FLOOR PLAN



FIFTH & SIXTH FLOOR PLANS

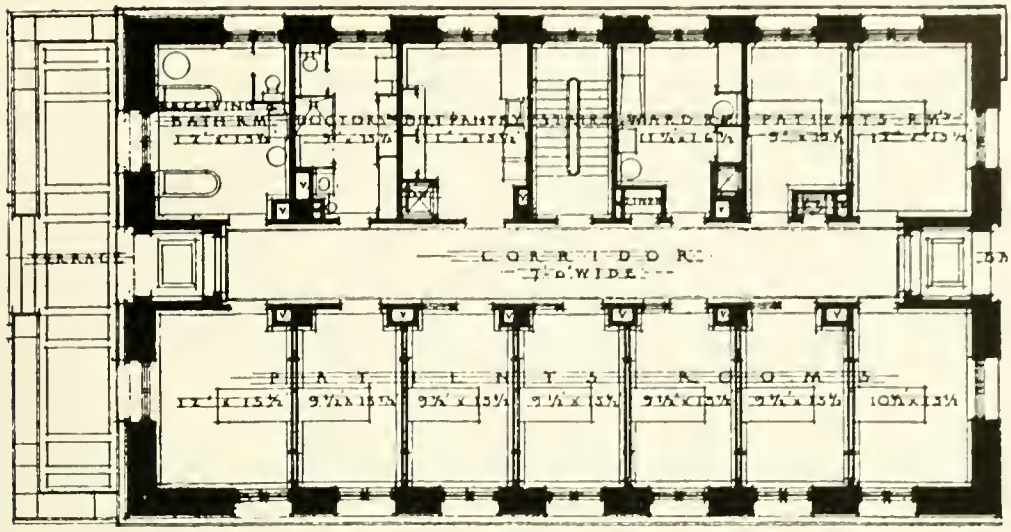


FOURTH FLOOR PLAN

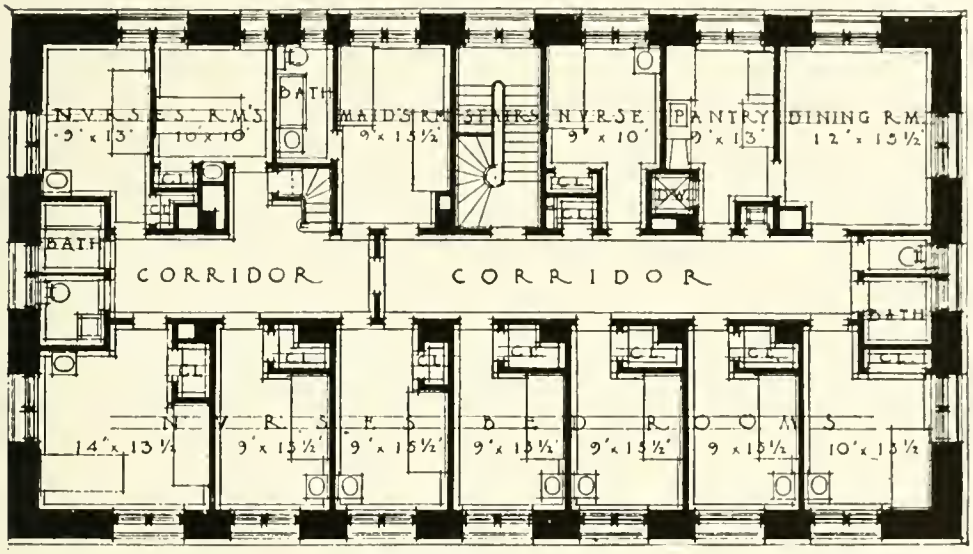
HOSPITAL BUILDING

THE ROCKEFELLER INSTITUTE FOR MEDICAL RESEARCH, NEW YORK

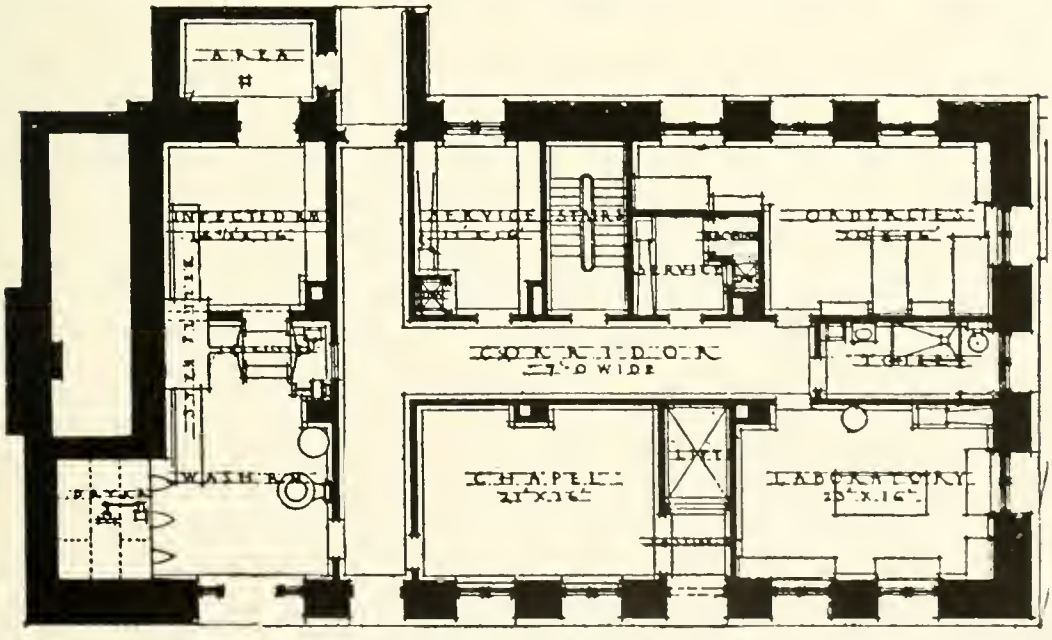
MESSRS. YORK & SAWYER, ARCHITECTS



FIRST FLOOR PLAN



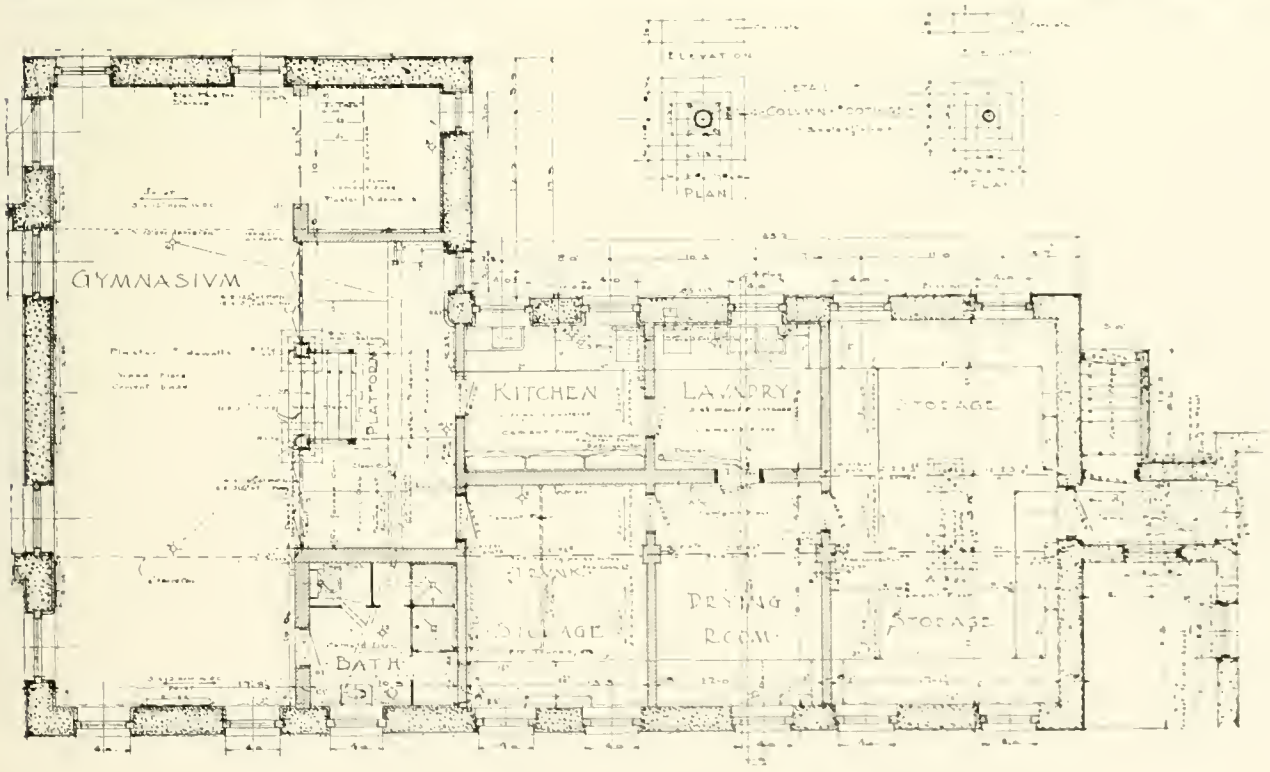
SECOND FLOOR PLAN



BASEMENT FLOOR PLAN—ISOLATION BUILDING

THE ROCKEFELLER INSTITUTE FOR MEDICAL RESEARCH, NEW YORK

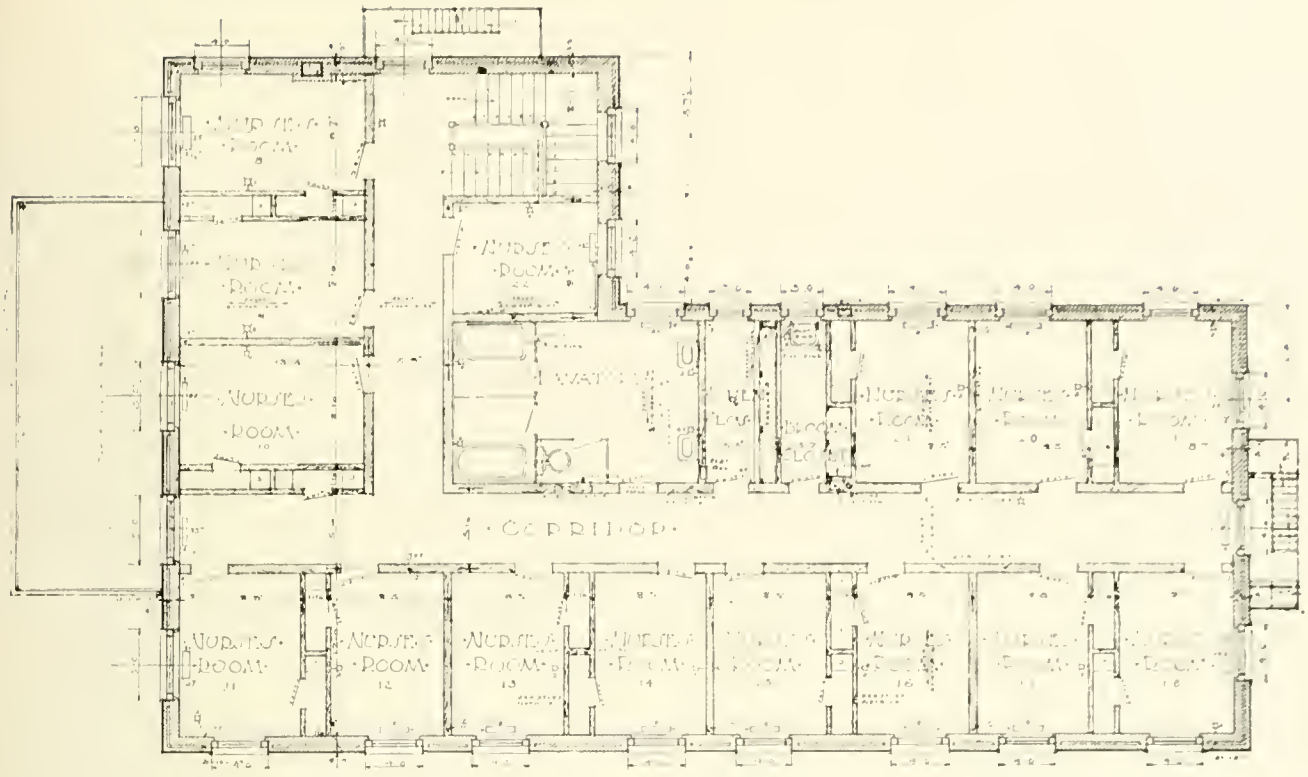
MESSRS. YORK & SAWYER, ARCHITECTS



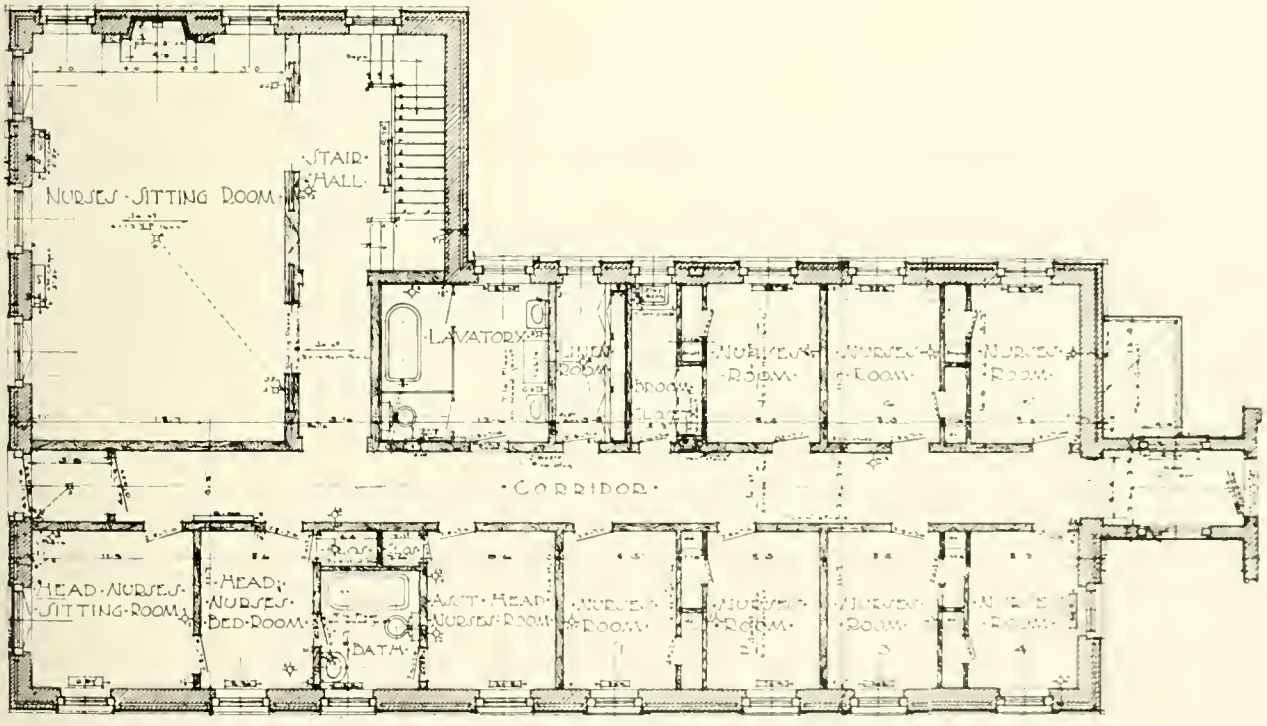
NURSES' HOME, MEMORIAL HOSPITAL, NIAGARA FALLS, N. Y.

MESSRS. GREEN & WICKS, ARCHITECTS

PLATE 10



SECOND FLOOR PLAN

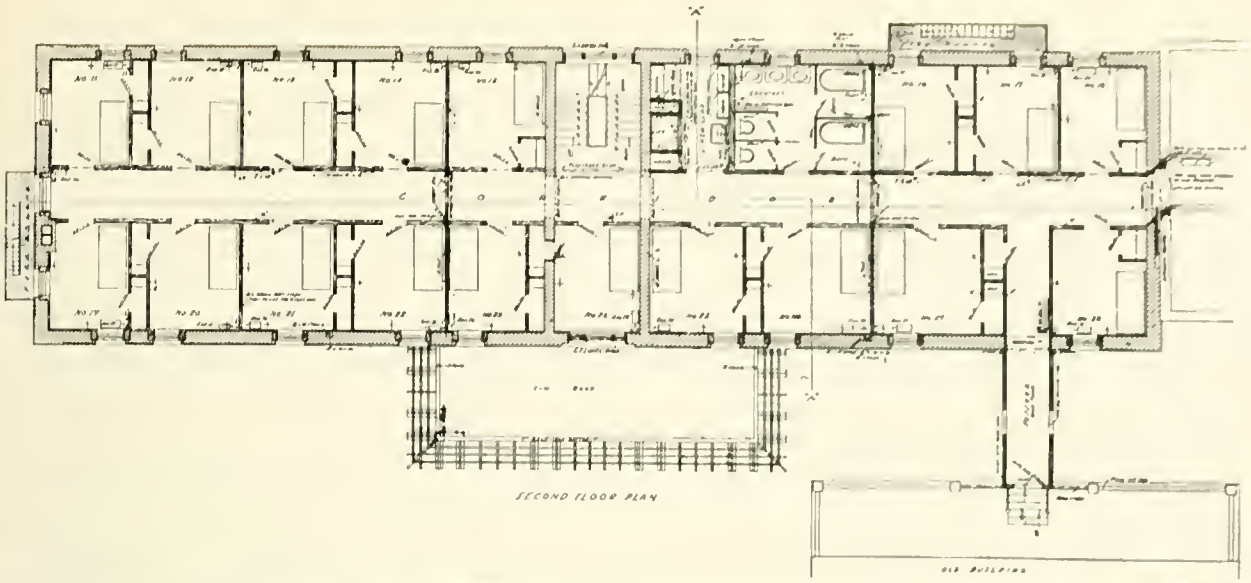


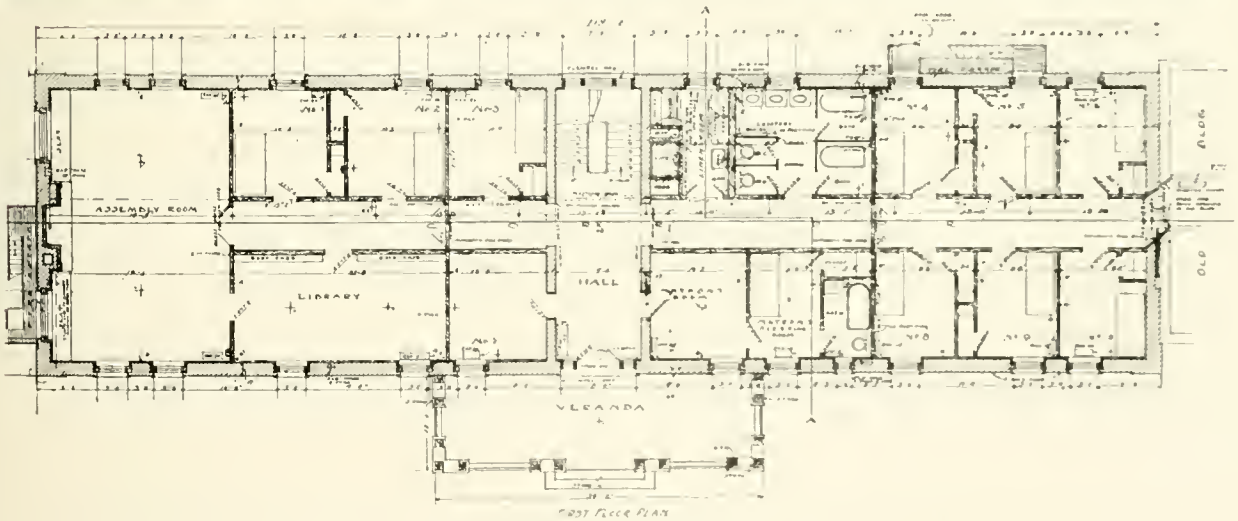
FIRST FLOOR PLAN

NURSES' HOME, MEMORIAL HOSPITAL, NIAGARA FALLS, N. Y.

MESSRS. GREEN & WICKS, ARCHITECTS

PLATE 11





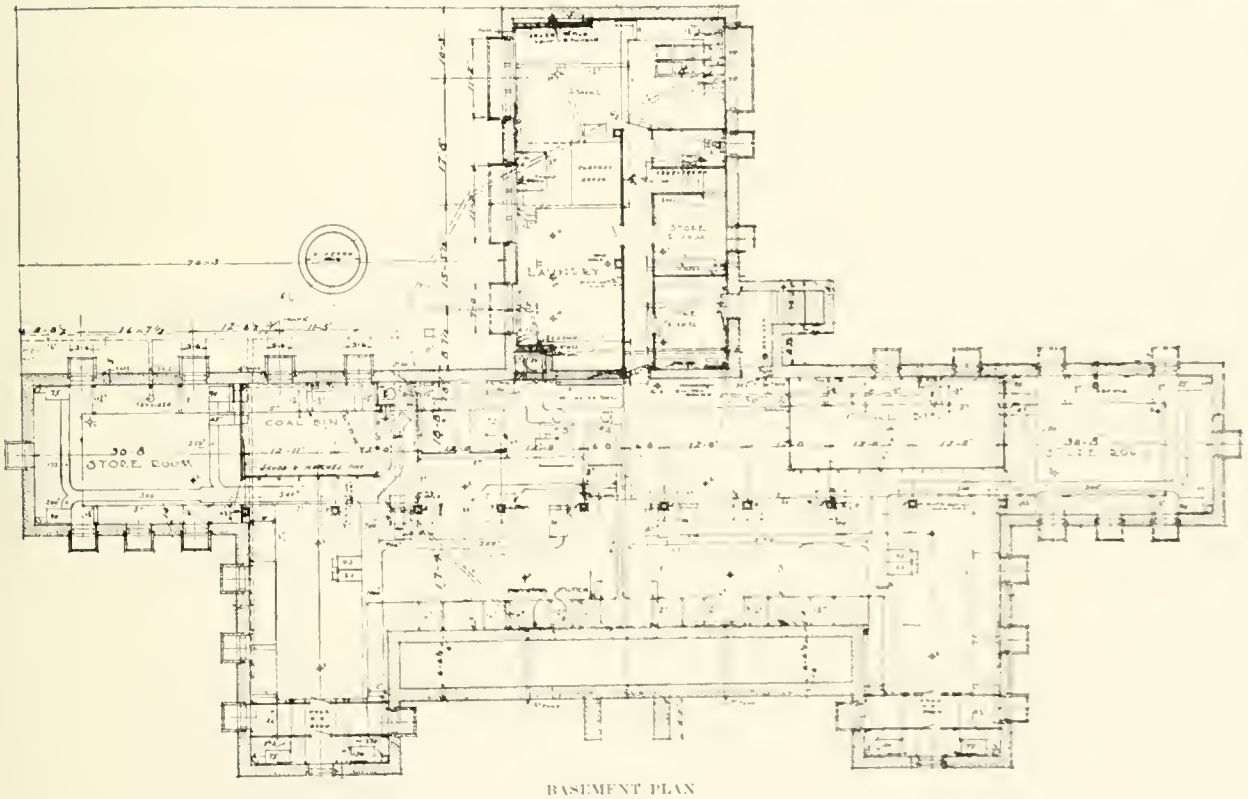
NURSES' HOME, GENERAL HOSPITAL, BUFFALO N. Y.

MESSRS. GREEN & WICKS, ARCHITECTS

CHILDREN'S HOSPITAL, BUFFALO, N. Y.

MESSRS. GREEN & WICKS, ARCHITECTS

PLATE 13

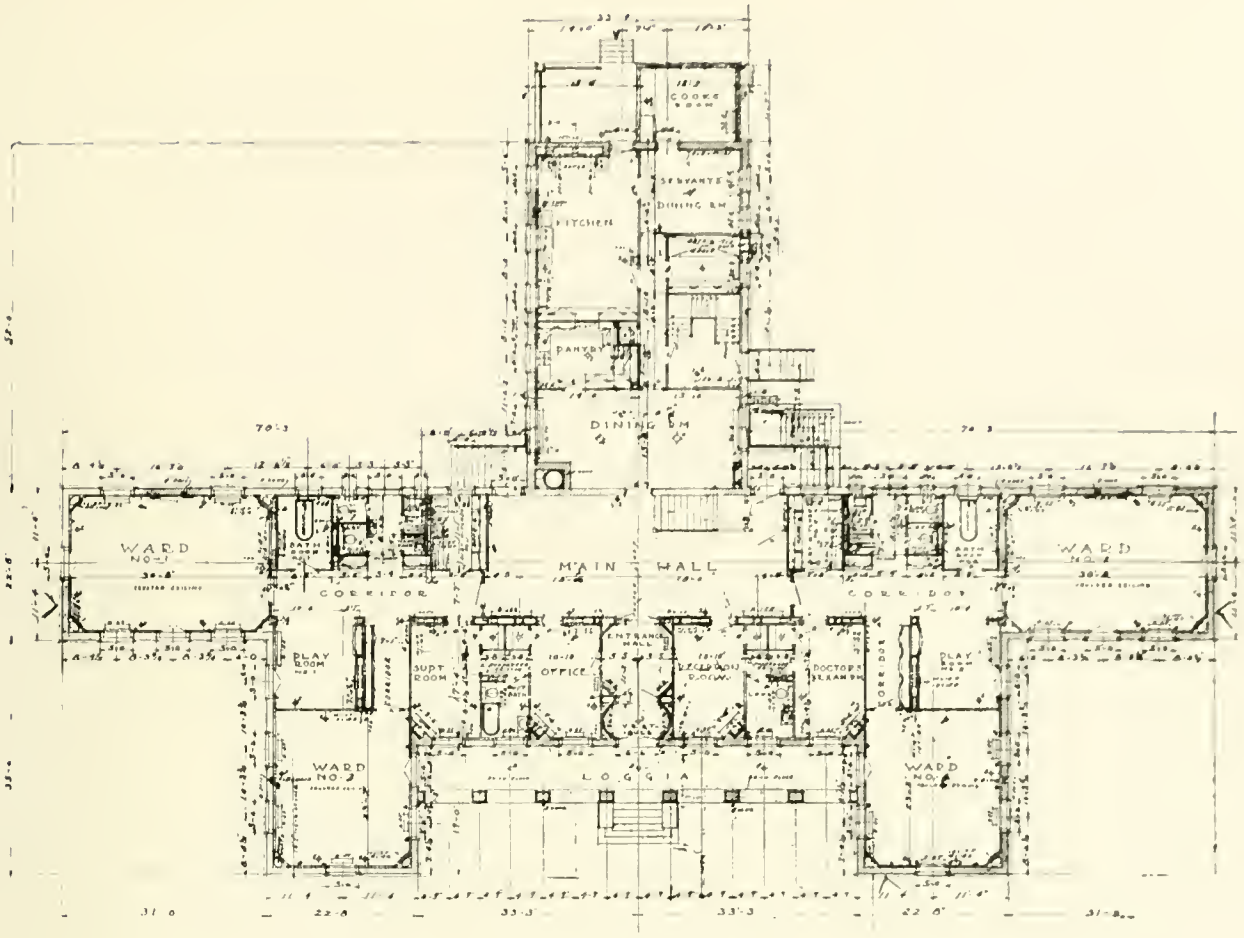


BASEMENT PLAN

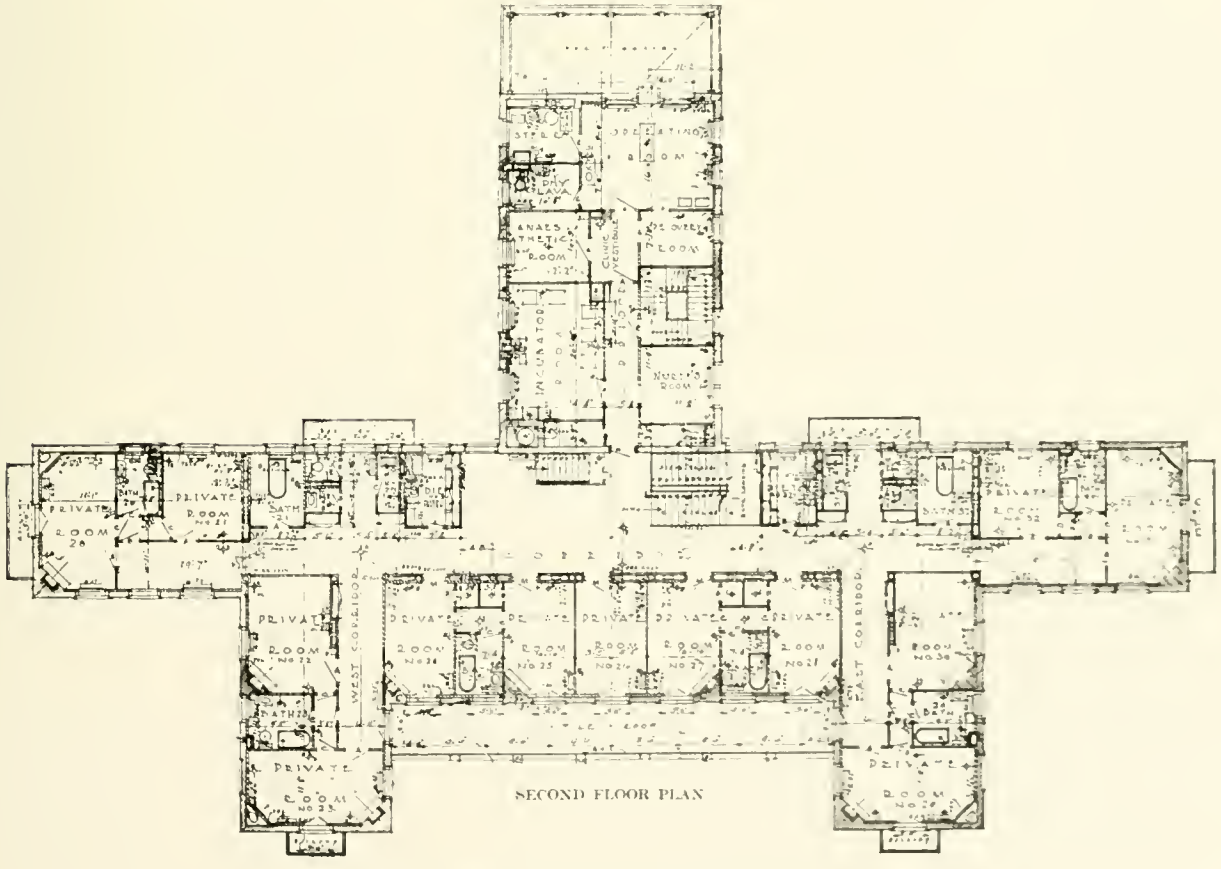
CHILDREN'S HOSPITAL, BUFFALO, N. Y.

MESSRS. GREEN & WICKS, ARCHITECTS

PLATE 14



FIRST FLOOR PLAN

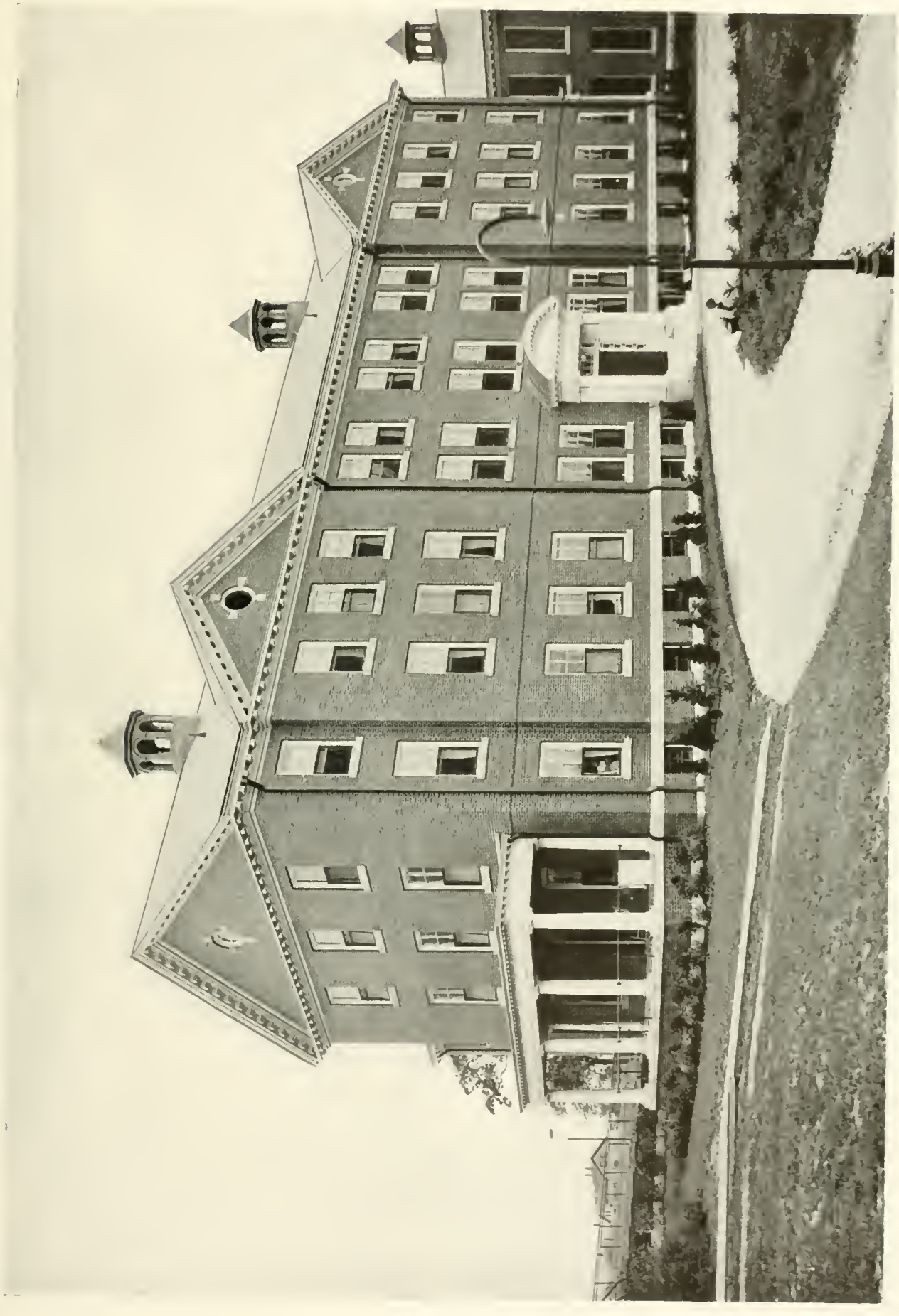


SECOND FLOOR PLAN

CHILDREN'S HOSPITAL, BUFFALO, N. Y.

MESSRS. GREEN & WICKS, ARCHITECTS

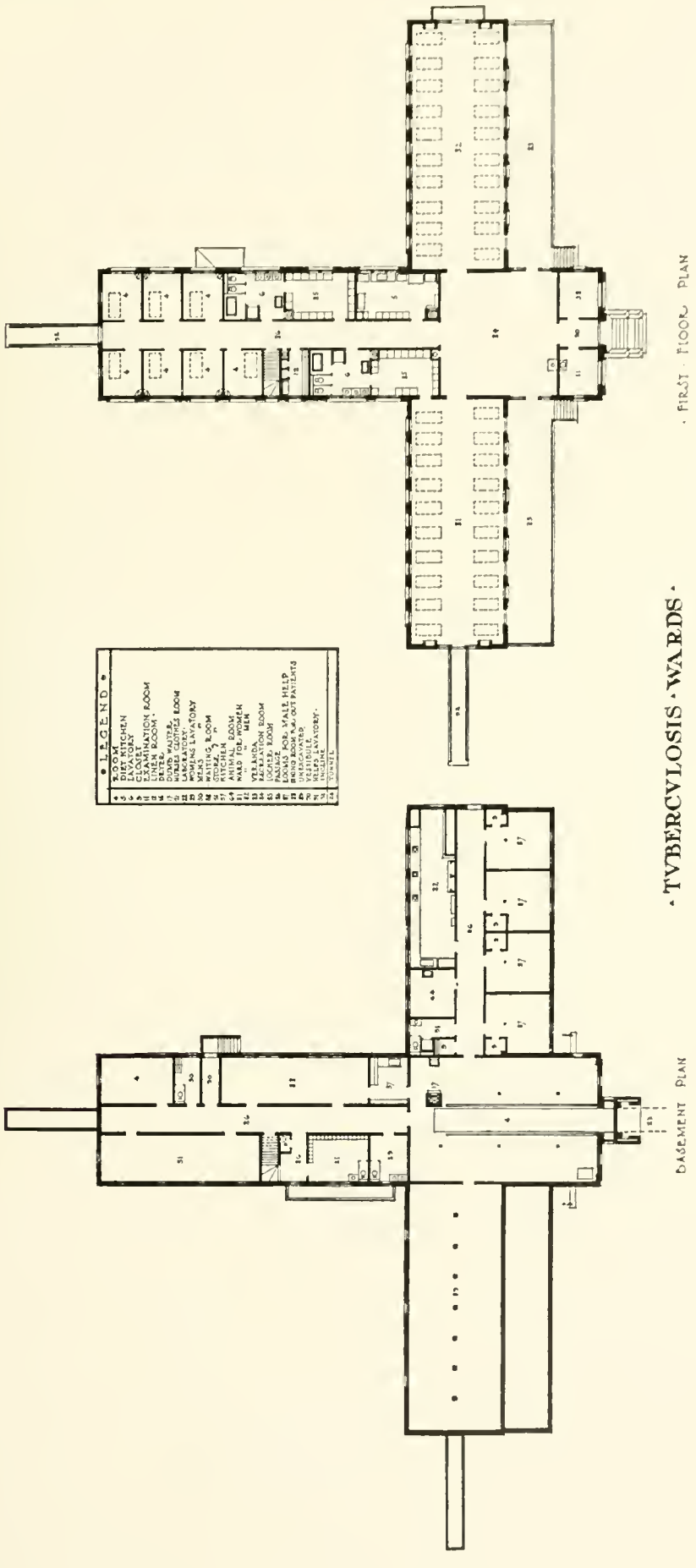
PLATE 15



ADMINISTRATION BUILDING, PROVIDENCE CITY HOSPITAL, PROVIDENCE, R. I.

MESSRS. MARTIN & HALL, ARCHITECTS

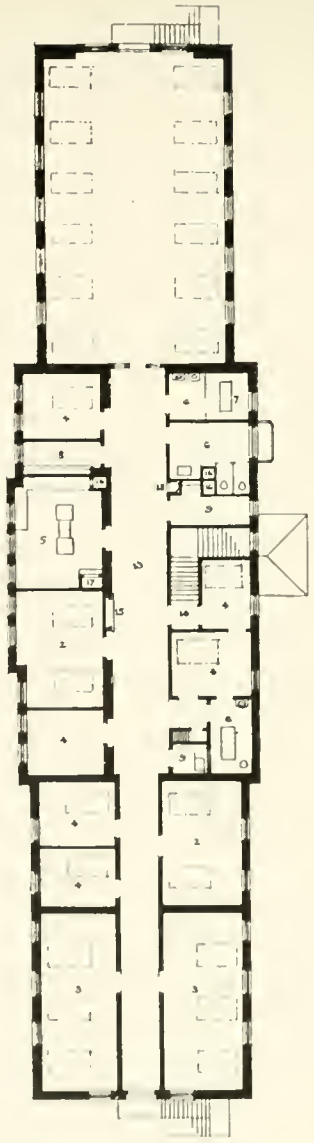
PLATE 16



PROVIDENCE CITY HOSPITAL, PROVIDENCE, R. I.

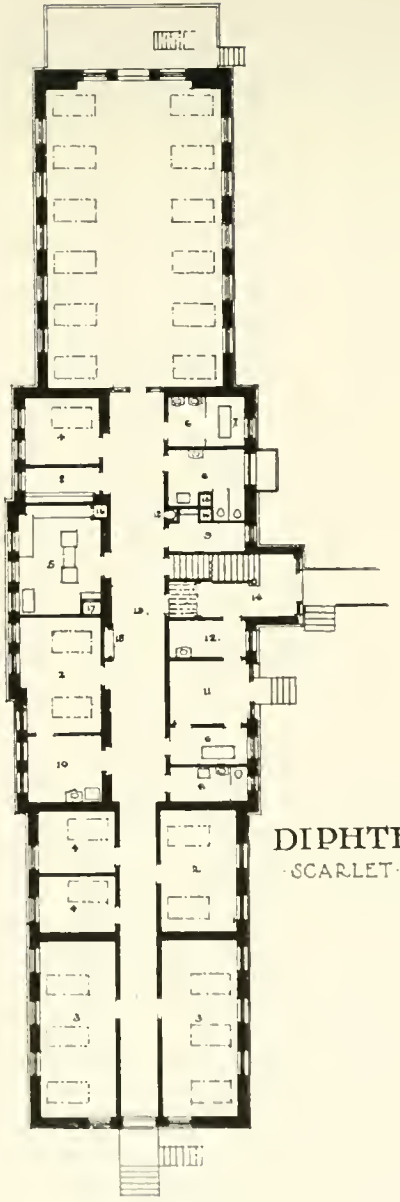
MESSRS. MARTIN & HALL, ARCHITECTS

TVBERCVLOSIS WARDS



SECOND FLOOR PLAN

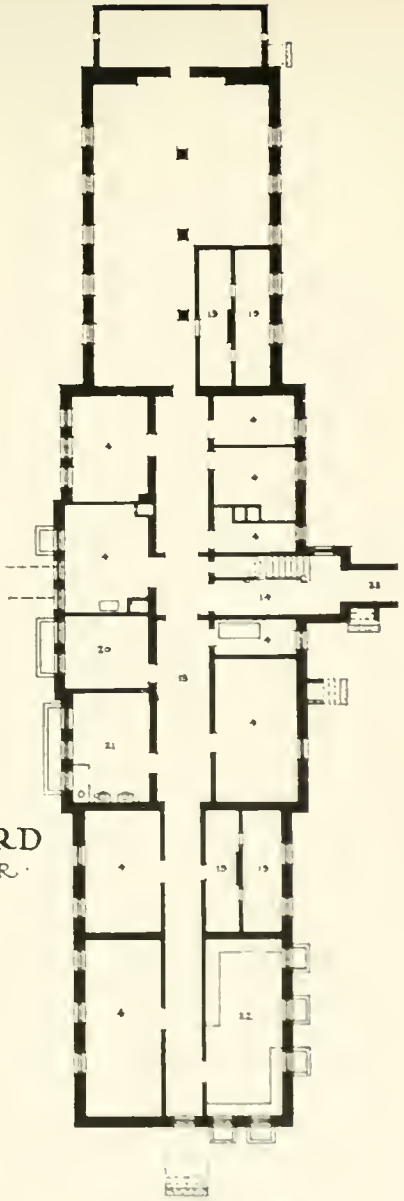
LEGEND	
1	TWELVE BED WARD
2	TWO " "
3	THREE " "
4	ROOM
5	DIET KITCHEN
6	LAVATORY
7	BATH
8	LINEN CLOSET
9	CLOSET
10	OPERATING ROOM
11	EXAMINING "
12	ROBING "
13	CORRIDOR
14	STAIR HALL
15	MEDICINE CLOSET
16	DRYER
17	DUMB WAITER
18	CHUTE
19	HEATING CHAMBER
20	PATIENTS' CLOTHES ROOM
21	NURSES' " "
22	LABORATORY
23	TUNNEL



FIRST FLOOR PLAN

DIPHTHERIA · WARD

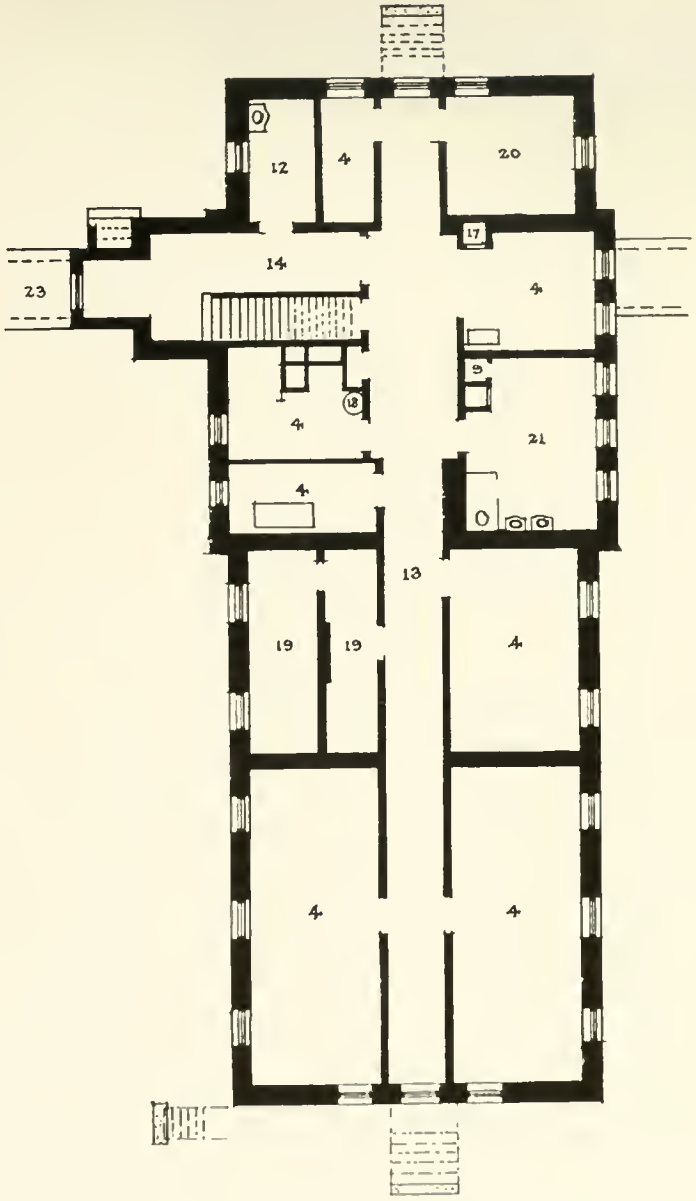
SCARLET FEVER WARD SIMILAR



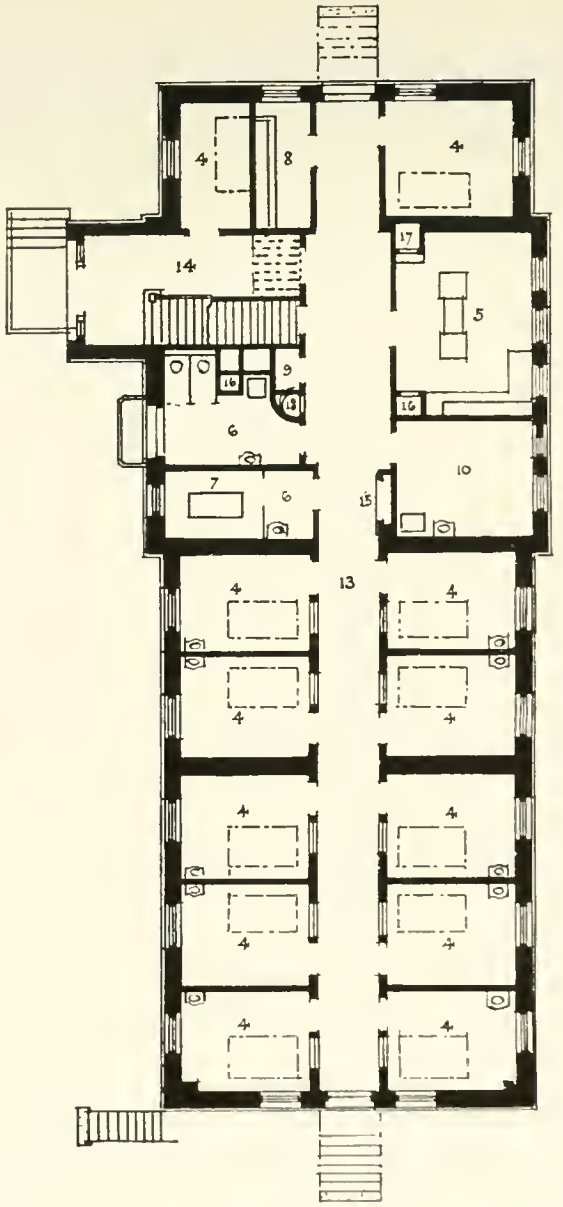
BASEMENT PLAN

PROVIDENCE CITY HOSPITAL, PROVIDENCE, R. I.

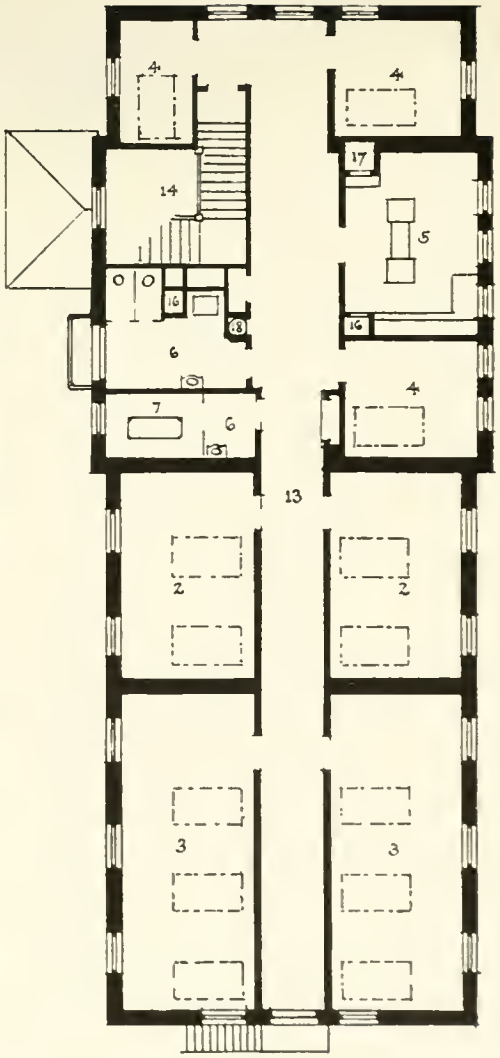
MESSRS. MARTIN & HALL, ARCHITECTS



BASEMENT · PLAN



FIRST · FLOOR · PLAN



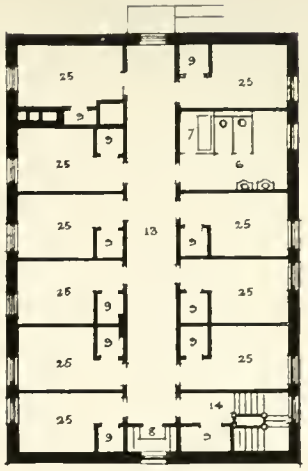
· SECOND · FLOOR · PLAN ·

2	Two Bed Ward.	5.	Diet Kitchen.	8.	Linen Closet.	12.	Robing Room.	15.	Medicine Closet.
3	Three Bed Ward.	6.	Lavatory.	9.	Closet.	13.	Corridor.	16.	Dryer.
4	Room.	7.	Bath.	10.	Operating Room.	14.	Stair Hall.	17.	Dumb Waiter.

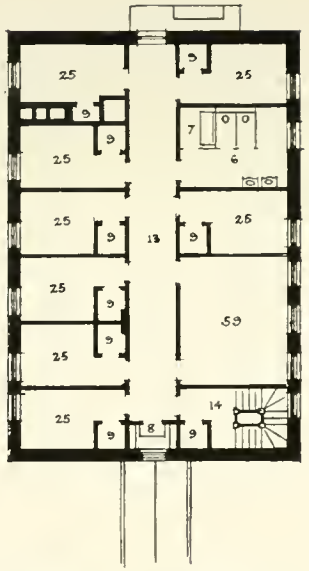
18.	Chute.	21.	Nurses' Clothes Room.
19.	Heating Chamber.	23	Tunnel.
20.	Patients' Clothes Room.		

ISOLATION WARD, PROVIDENCE CITY HOSPITAL

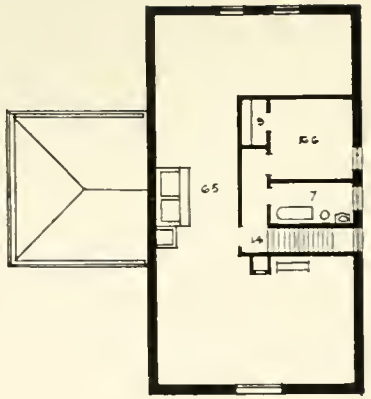
MESSRS. MARTIN & HALL, ARCHITECTS



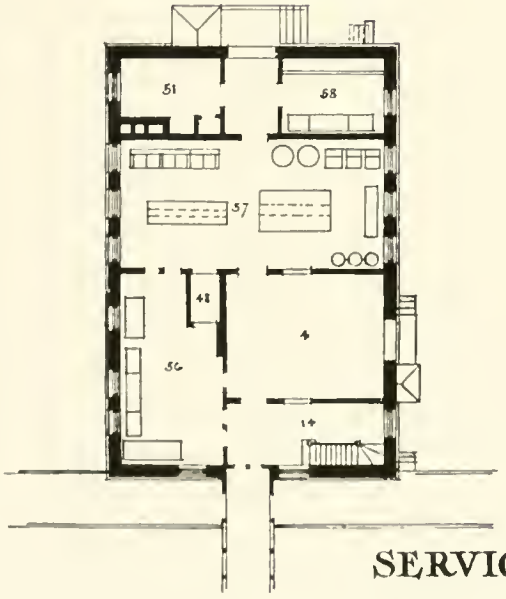
THIRD · FLOOR · PLAN



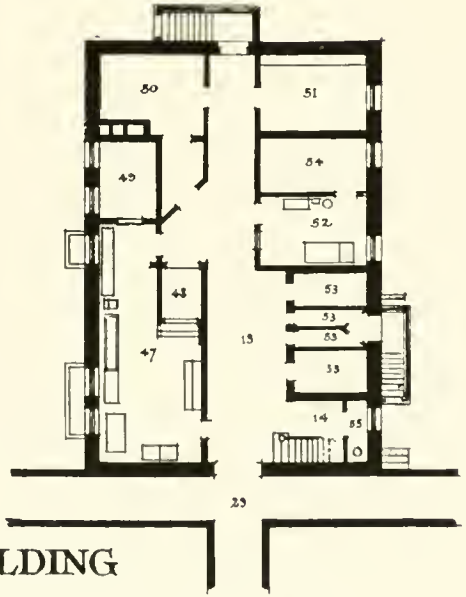
SECOND · FLOOR · PLAN



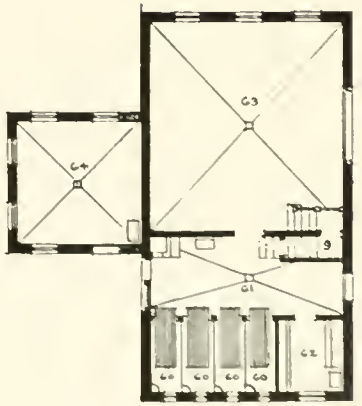
SECOND · FLOOR · PLAN



FIRST FLOOR PLAN



BASEMENT PLAN



FIRST · FLOOR · PLAN

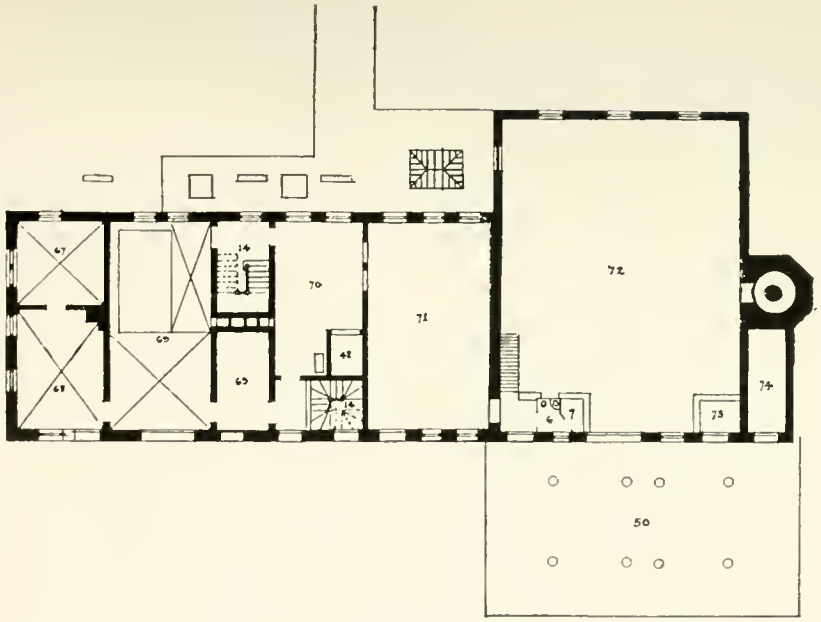
SERVICE · BUILDING

· STABLE ·

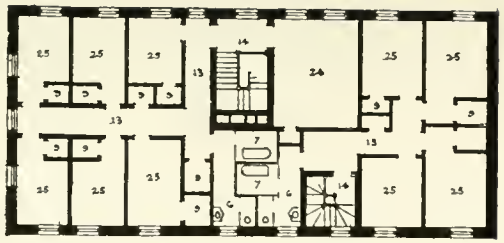
4. Room.
6. Lavatory.
7. Bath.
8. Linen Closet.
9. Closet.
13. Corridor.
14. Stair Hall.
23. Tunnel.
25. Chamber.
47. Bakery.
48. Elevator.
49. Oven. 50. Coal.
51. Storage.
52. Ice Cream Room.
53. Refrigerator.
54. Tank Room.
55. W. C.
56. Dish Washing Room.
57. Kitchen.
58. Scullery.
59. Sitting Room.
60. Stalls.
61. Stable.
62. Harness Case.
63. Ambulance Room.
64. Animal House.
65. Hay and Storage Loft.
66. Man's Room

PROVIDENCE CITY HOSPITAL

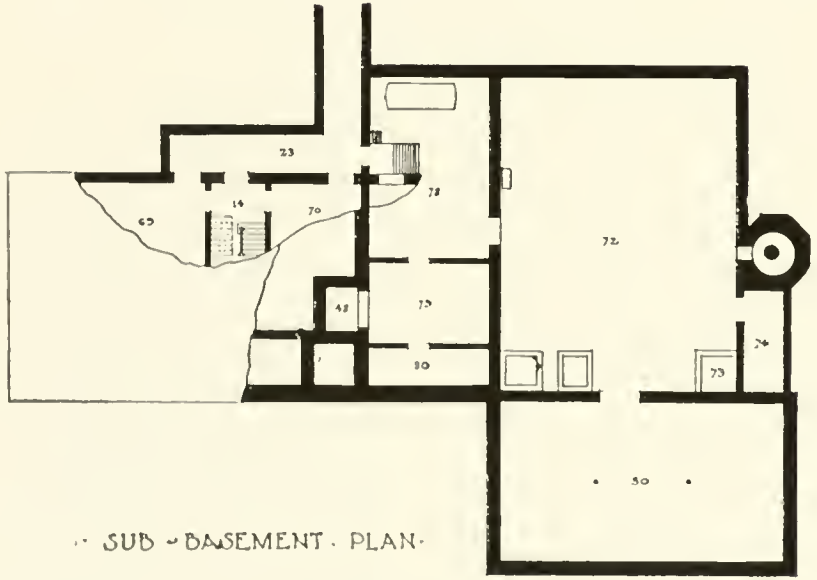
MESSRS. MARTIN & HALL, ARCHITECTS



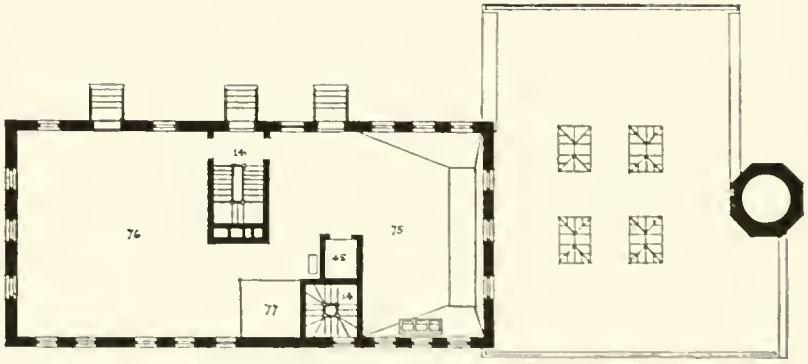
BASEMENT PLAN



SECOND FLOOR PLAN



SUB-BASEMENT PLAN



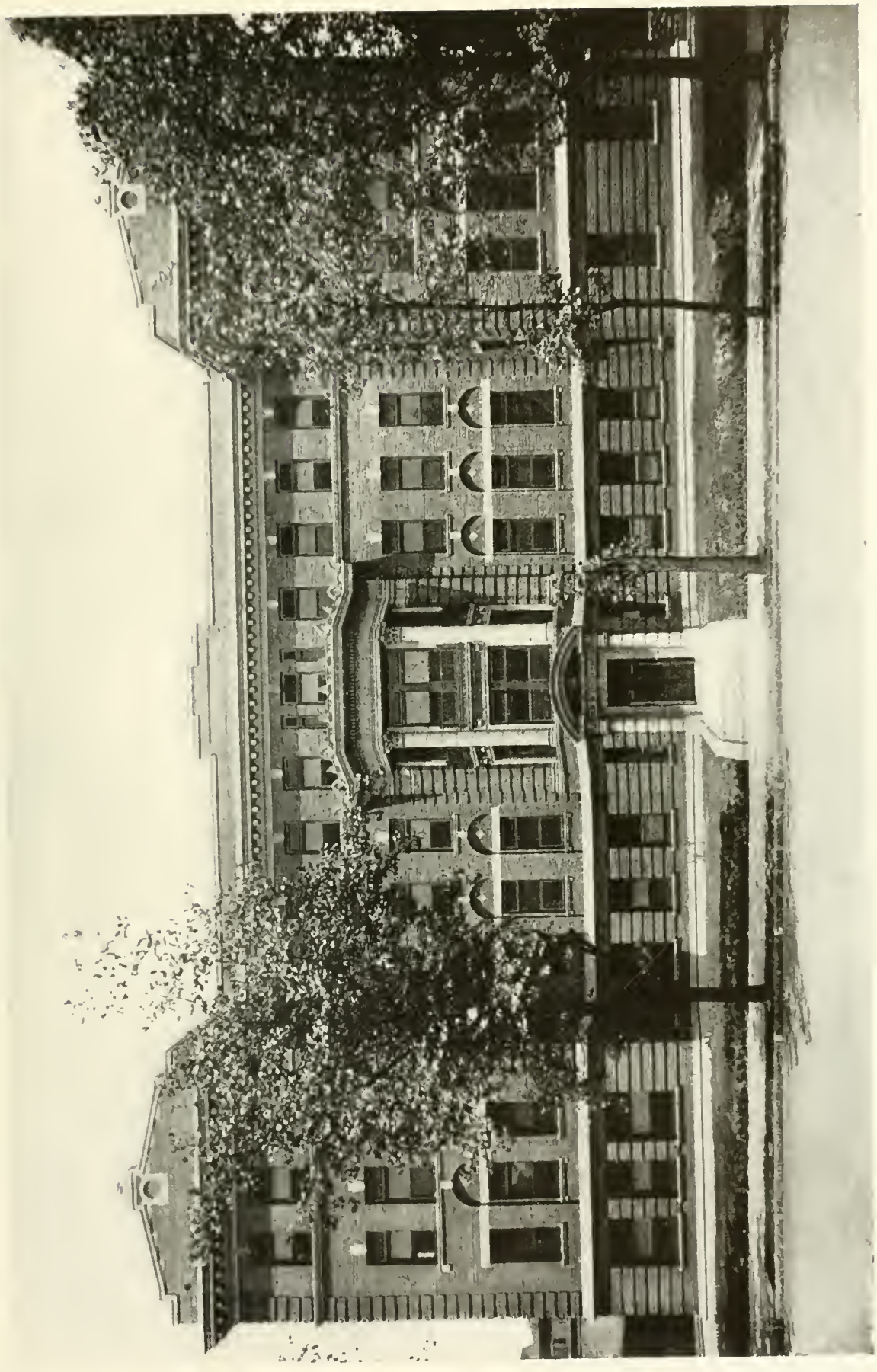
FIRST FLOOR PLAN

POWER HOUSE AND LAUNDRY

6. Lavatory.
7. Bath.
9. Closet.
14. Stair Hall.
23. Tunnel.
24. Sewing Room.
25. Chamber.
48. Elevator.
50. Coal.
67. Autopsy Room.
68. Morgue.
69. Disinfecting Room.
70. Sorting Room.
71. Carpenter Shop.
72. Boiler Room.
73. Lift.
74. Incinerator.
75. Laundry.
76. Ironing Room.
77. Drying Room.
78. Pump Room.
79. Motor Generator Room.
80. Transformer Room.

POWER HOUSE AND LAUNDRY, PROVIDENCE CITY HOSPITAL

MESSRS. MARTIN & HALL, ARCHITECTS



BARNARD SKIN AND CANCER HOSPITAL, ST. LOUIS, MO

MESSRS. MAURAN & RUSSELL, ARCHITECTS

PLATE 22

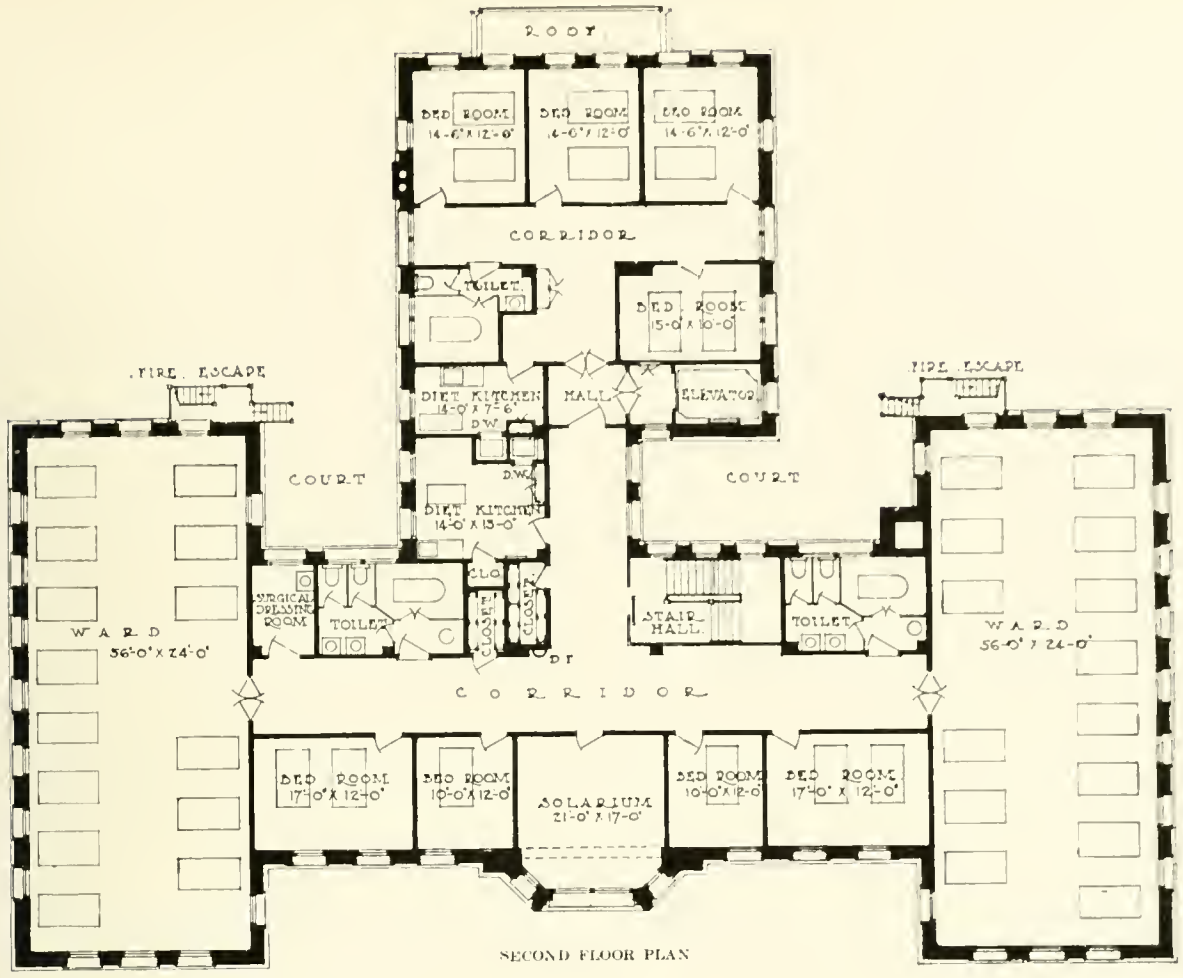
PLATE 93

BARNARD SKIN AND CANCER HOSPITAL

ST. LOUIS, MO.

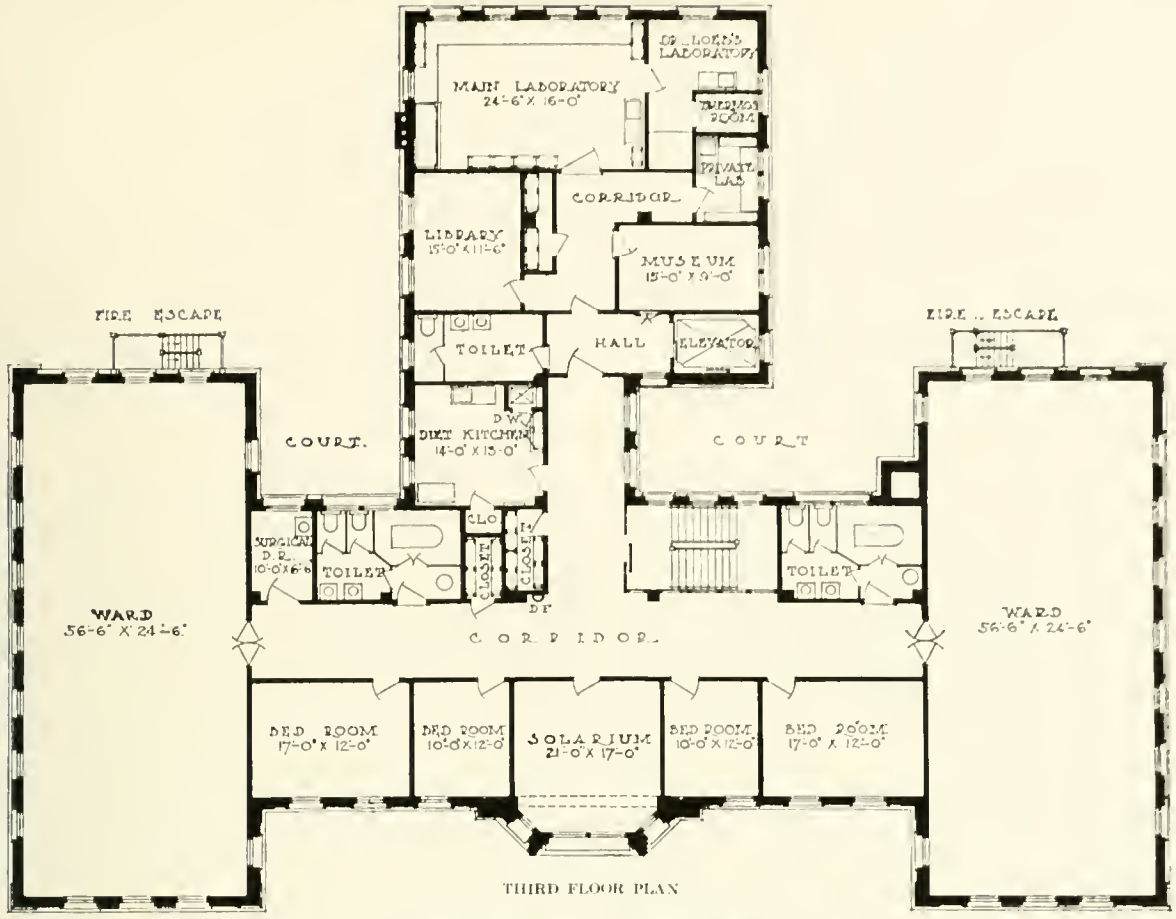
MESSRS. MAURAN & RUSSELL

ARCHITECTS

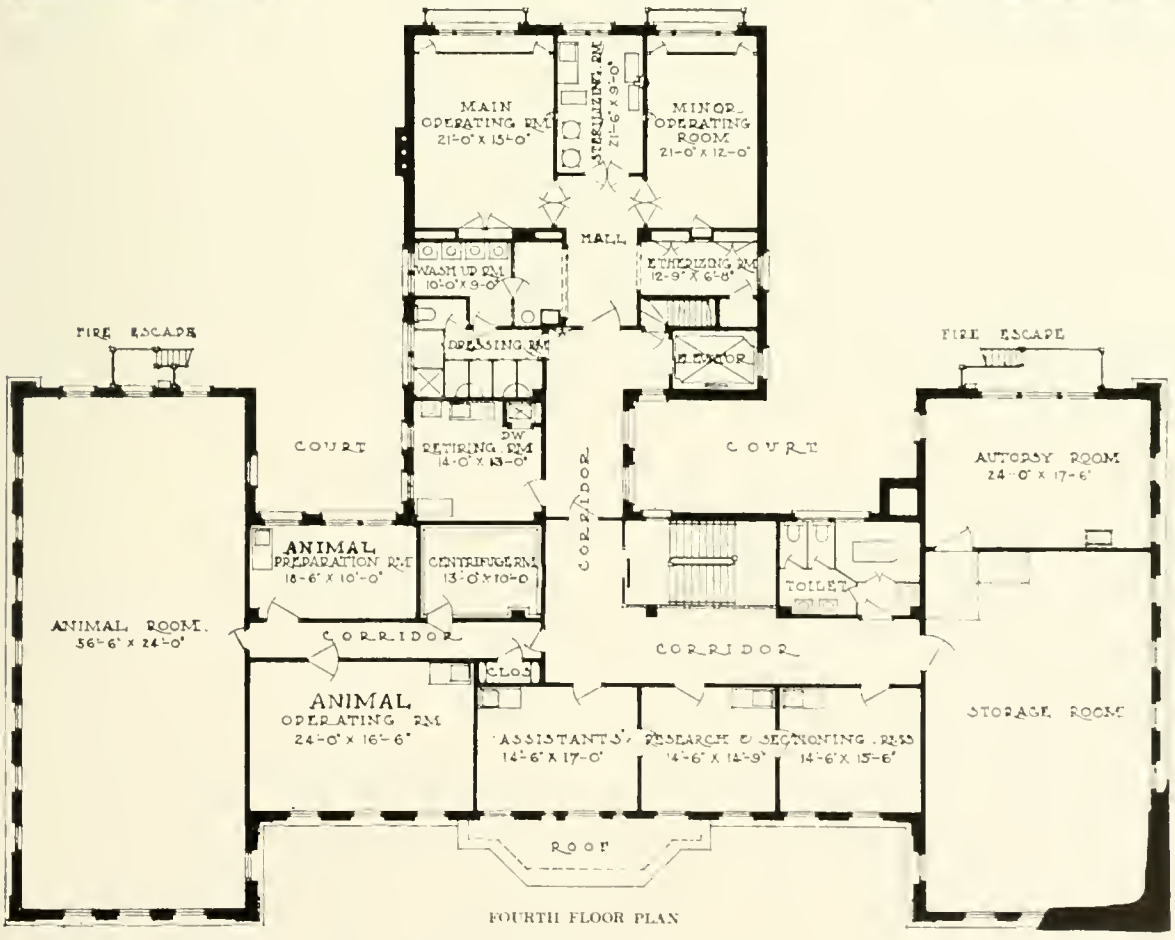


BARNARD SKIN AND CANCER HOSPITAL, ST. LOUIS, MO.

MESSRS. MAURAN & RUSSELL, ARCHITECTS



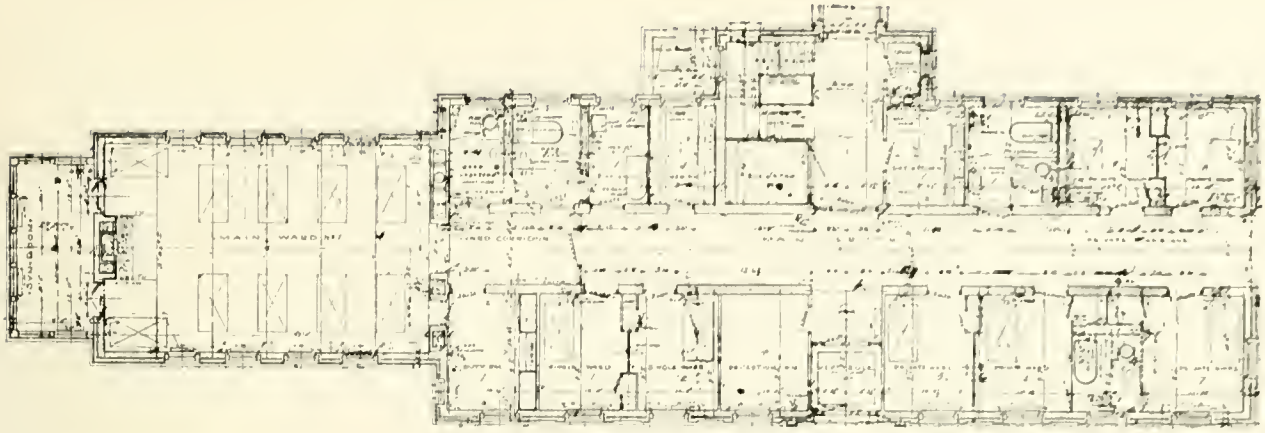
THIRD FLOOR PLAN

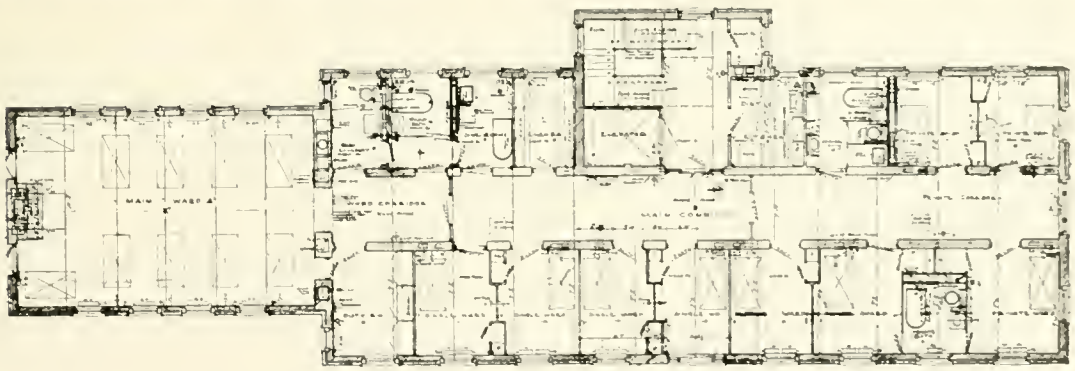


FOURTH FLOOR PLAN

BARNARD SKIN AND CANCER HOSPITAL, ST. LOUIS, MO.

MESSRS. MAURAN & RUSSELL, ARCHITECTS

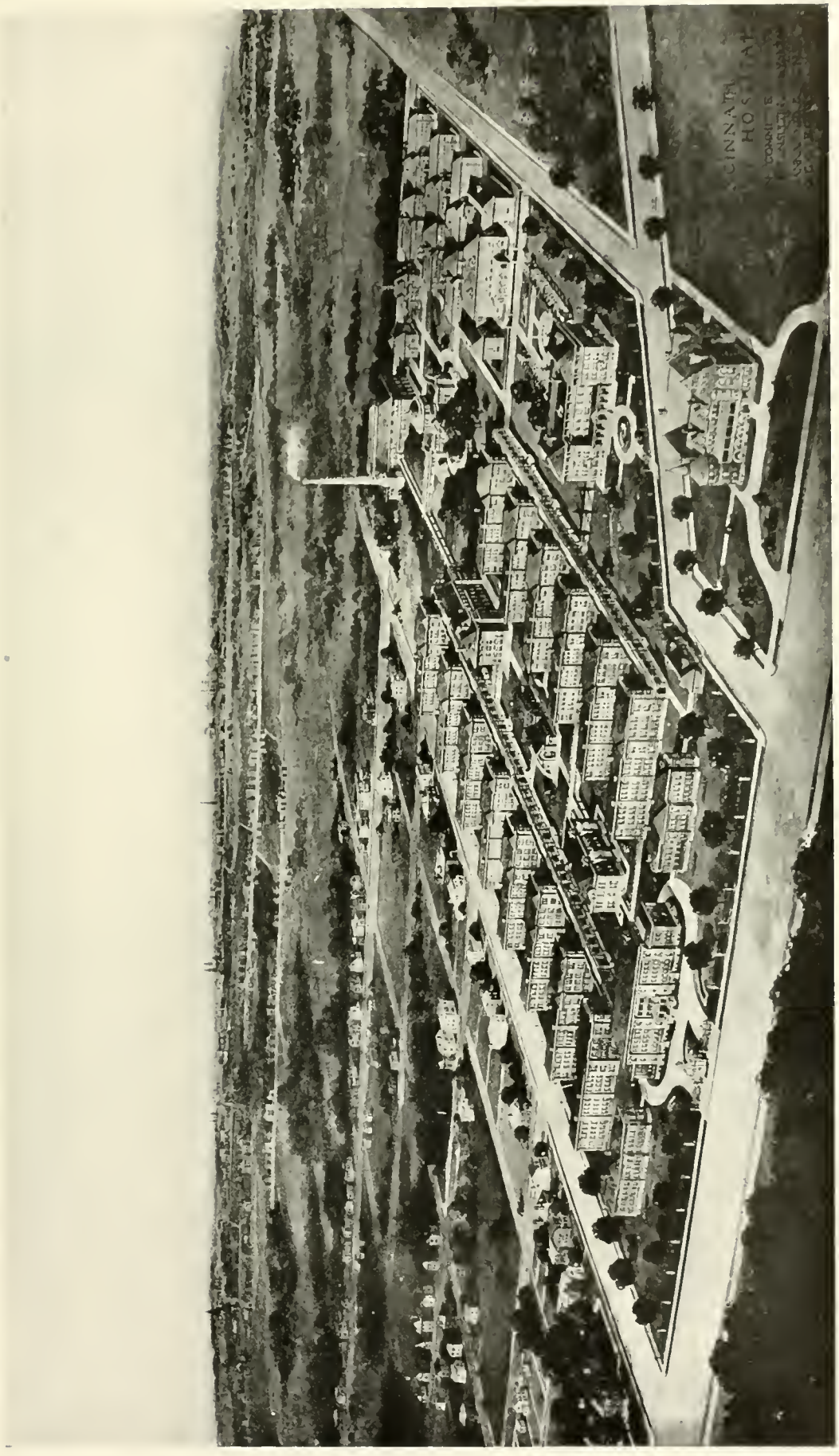




SURGICAL BUILDING, NIAGARA FALLS MEMORIAL HOSPITAL

MESSRS. GREEN & WICKS, ARCHITECTS

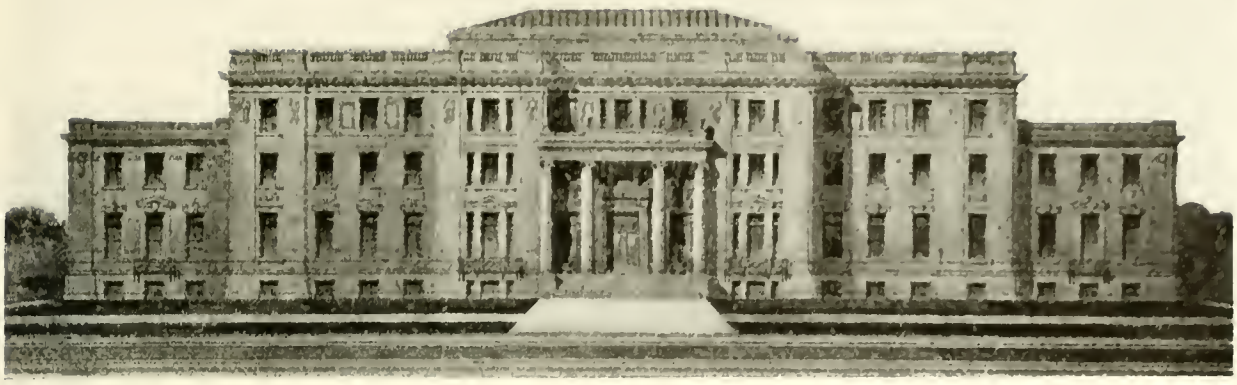
PLATE 26

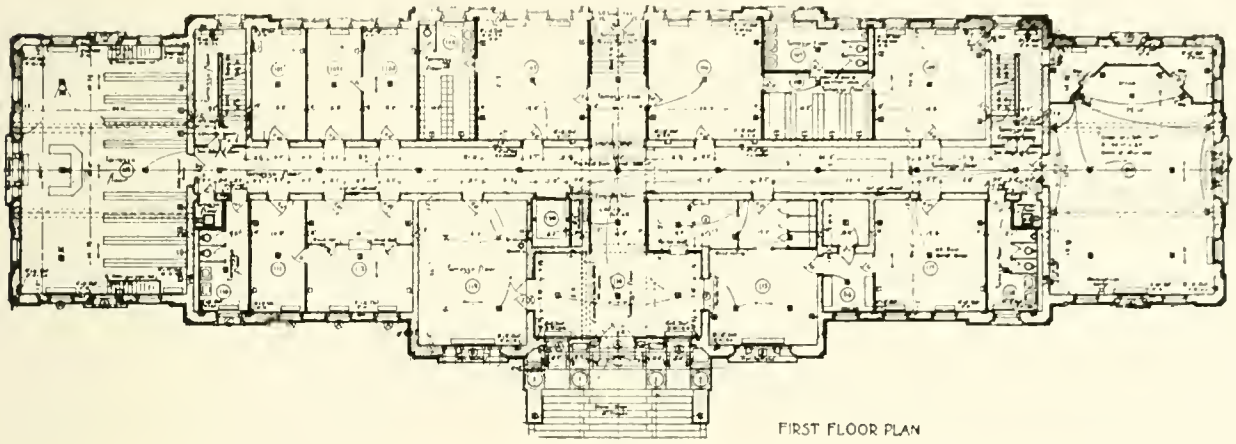


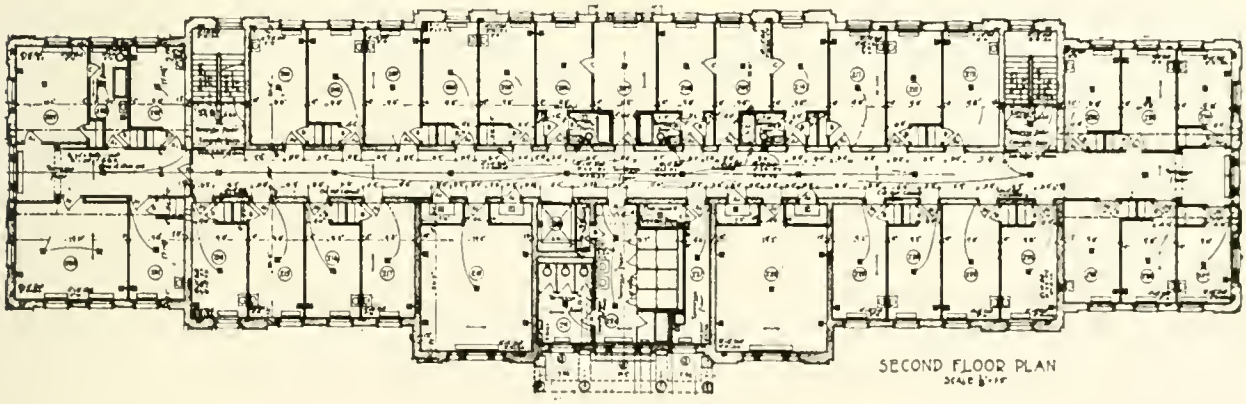
CINCINNATI GENERAL HOSPITAL, CINCINNATI, O.

PERSPECTIVE VIEW, PROPOSED GROUP

MESSRS. SAMUEL HANNAFORD & SONS, ARCHITECTS





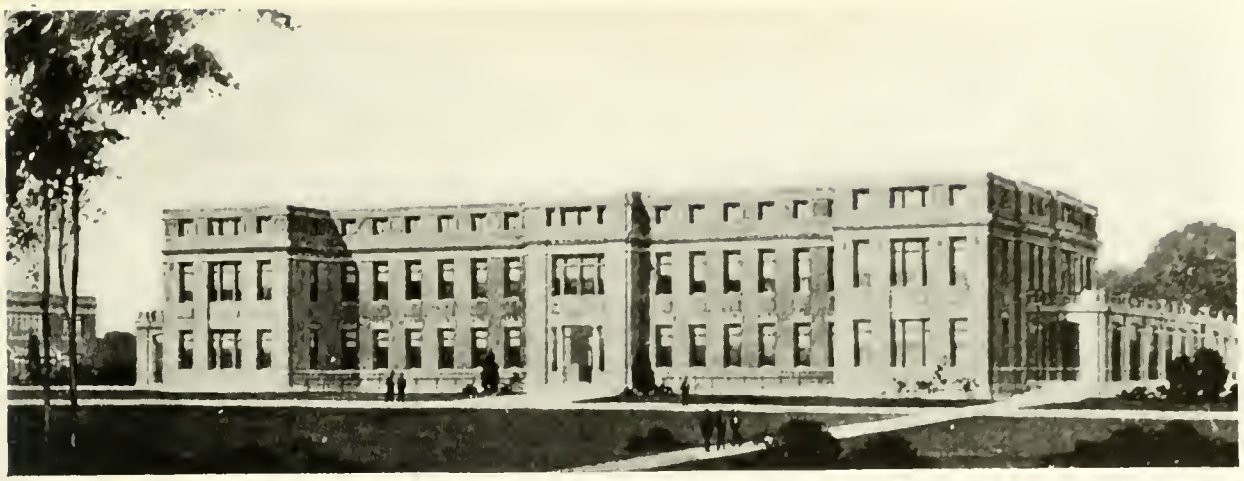


ADMINISTRATION BUILDING

CINCINNATI GENERAL HOSPITAL, CINCINNATI, O.

MESSRS. SAMUEL HANNAFORD & SONS, ARCHITECTS

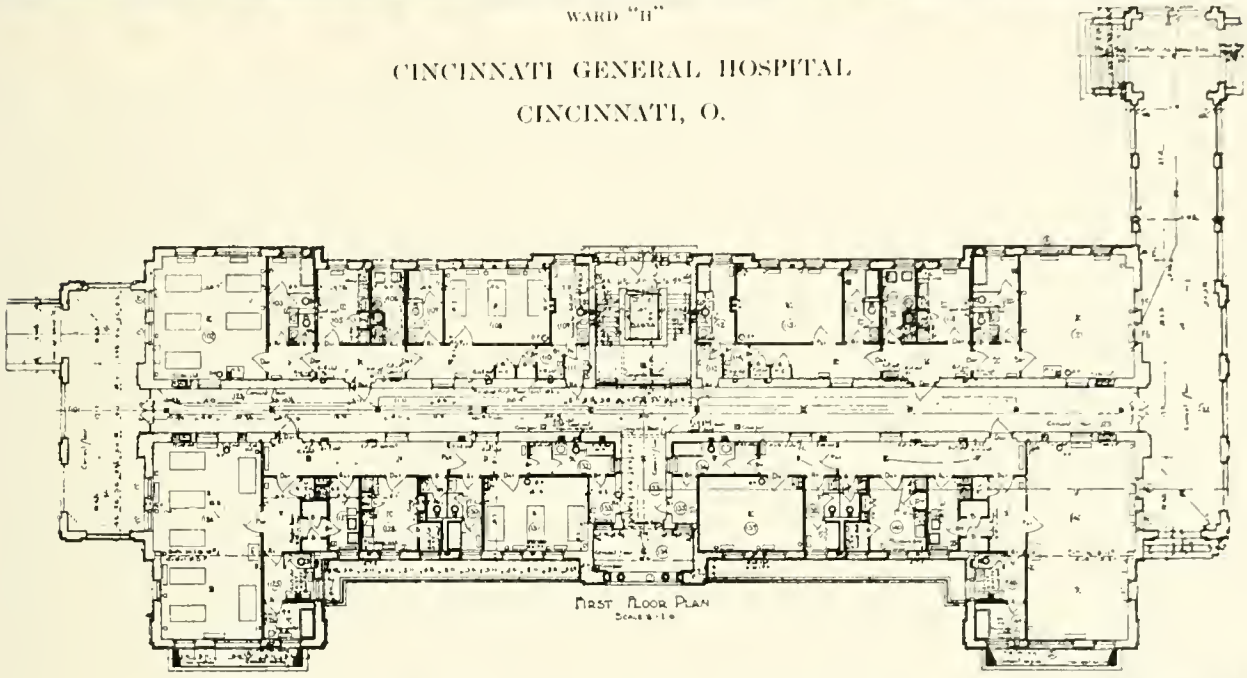
PLATE 28



WARD "H"

CINCINNATI GENERAL HOSPITAL

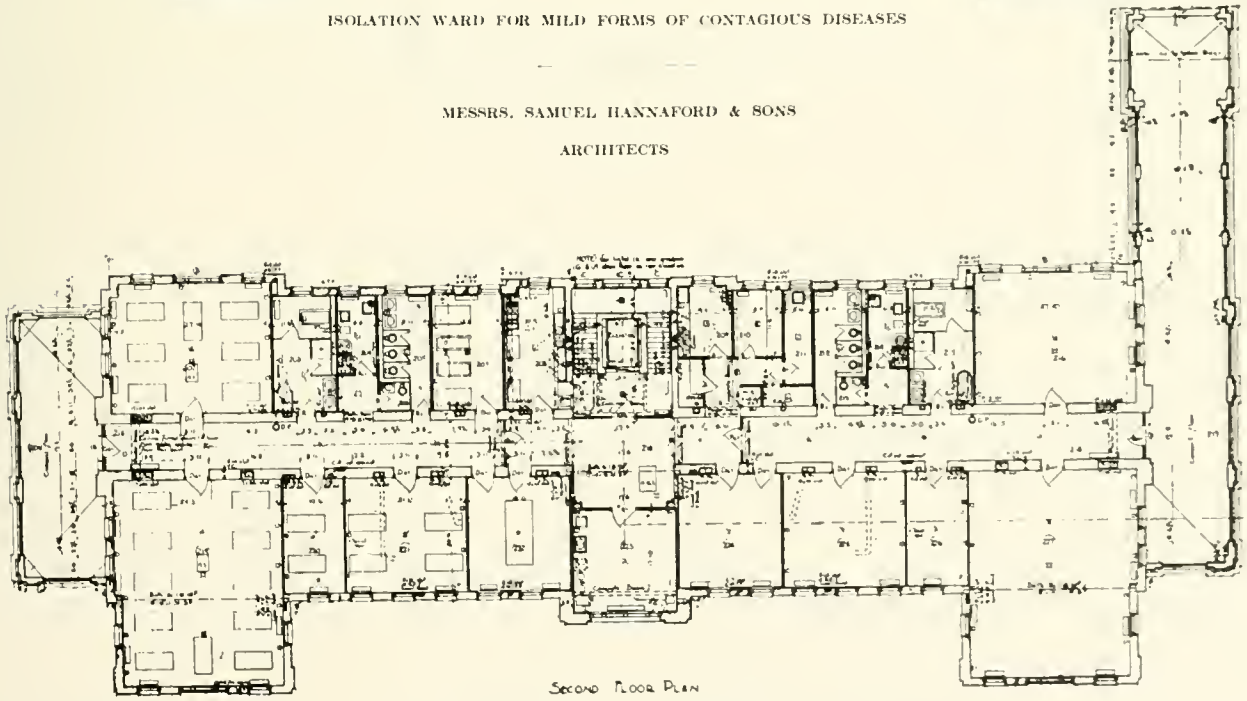
CINCINNATI, O.



ISOLATION WARD FOR MILD FORMS OF CONTAGIOUS DISEASES

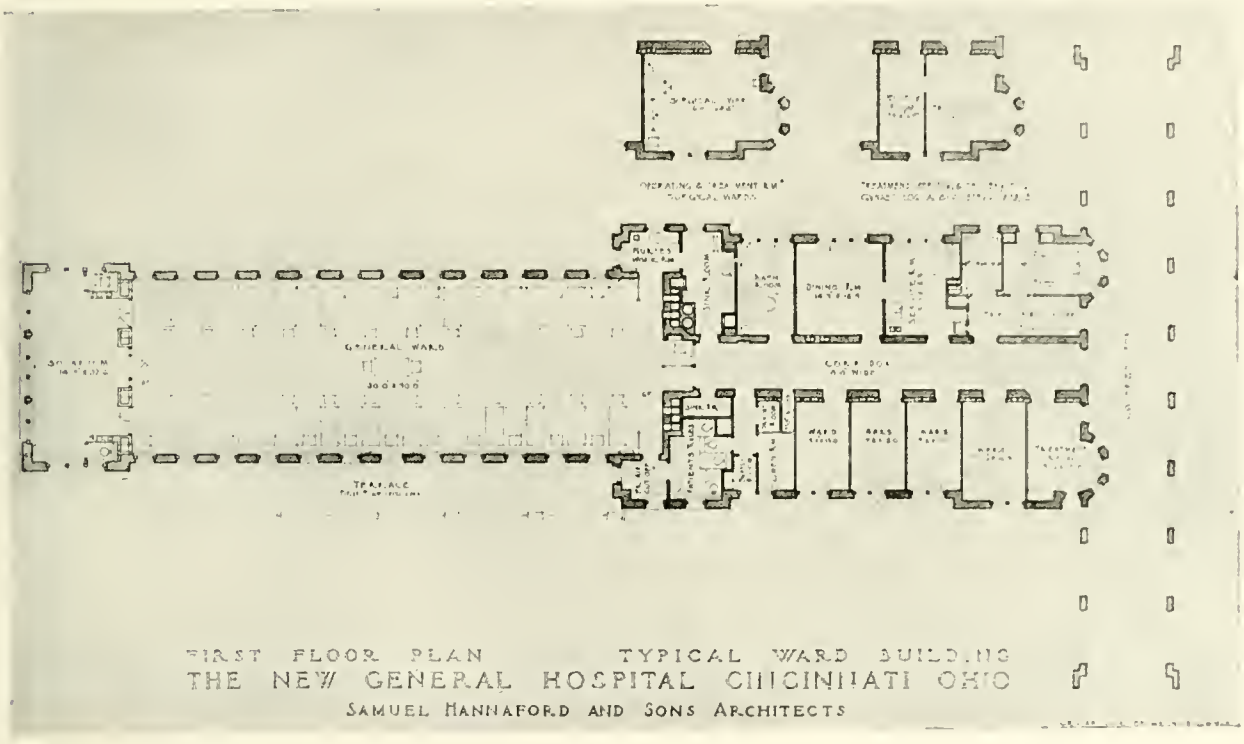
MESSRS. SAMUEL HANNAFORD & SONS

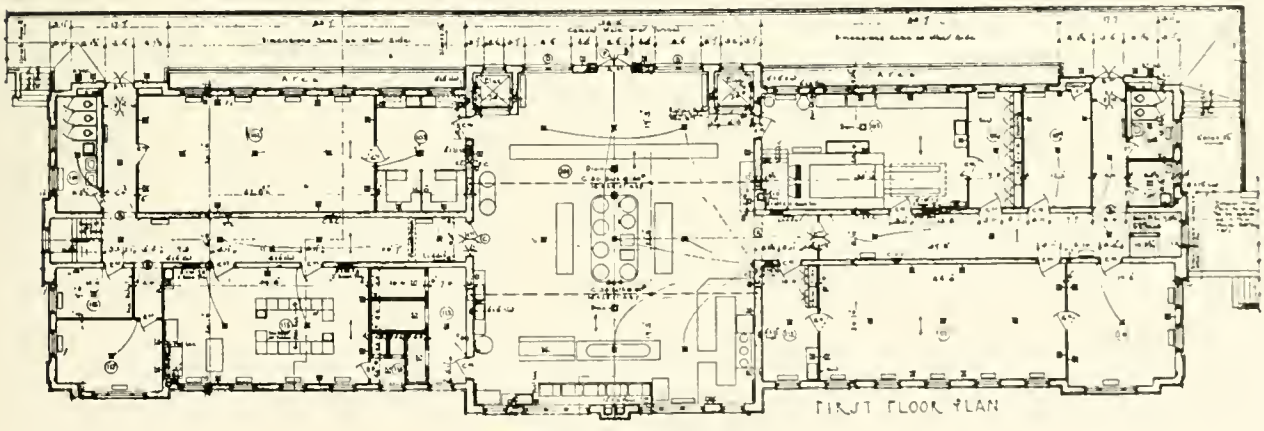
ARCHITECTS



MALE WARD FOR SKIN DISEASES

TYPICAL WARD BUILDINGS


FIRST FLOOR PLAN TYPICAL WARD BUILDING
THE NEW GENERAL HOSPITAL CINCINNATI OHIO
SAMUEL HANNAFORD AND SONS ARCHITECTS



KITCHEN AND SERVICE BUILDING

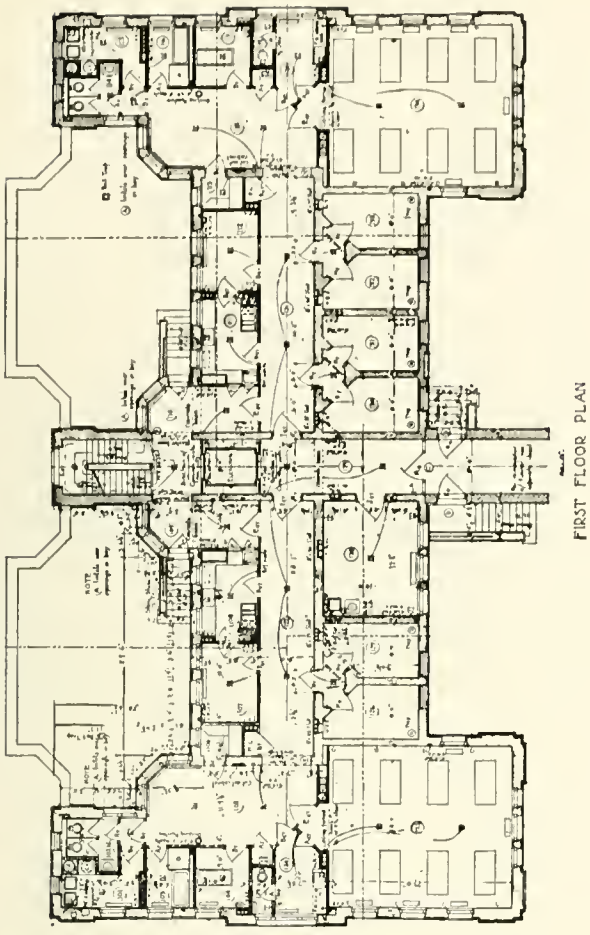
CINCINNATI GENERAL HOSPITAL, CINCINNATI, O.

MESSRS. SAMUEL HANNAFORD & SONS, ARCHITECTS

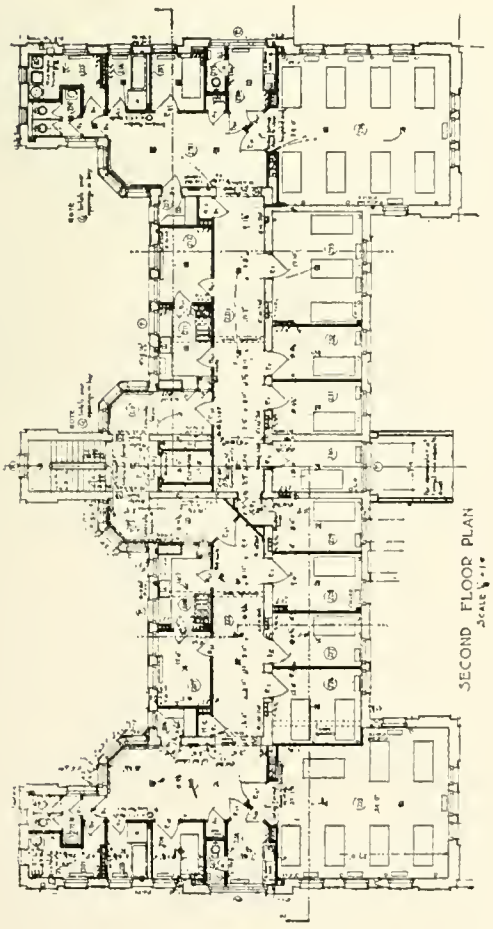
NEUROLOGICAL BUILDING

CINCINNATI GENERAL HOSPITAL
CINCINNATI, O.

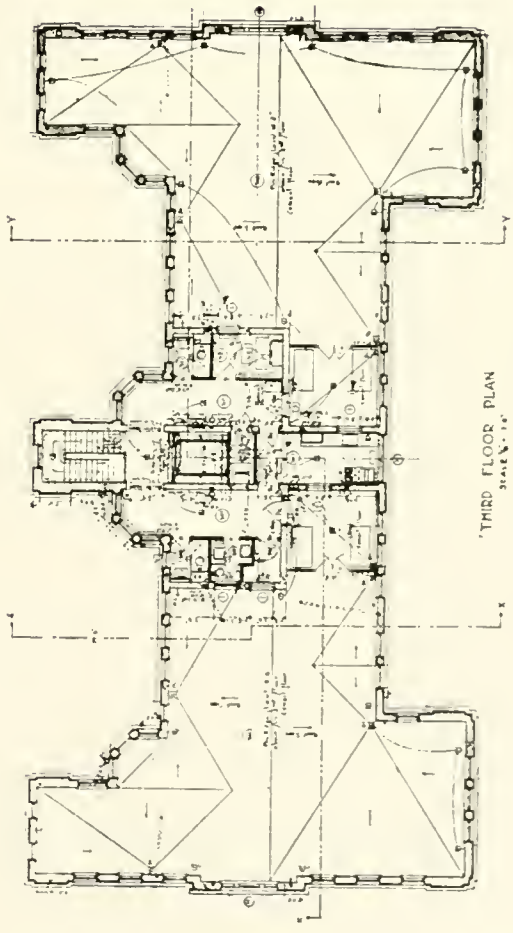
MESSRS. SAMUEL HANNAFORD & SONS
ARCHITECTS



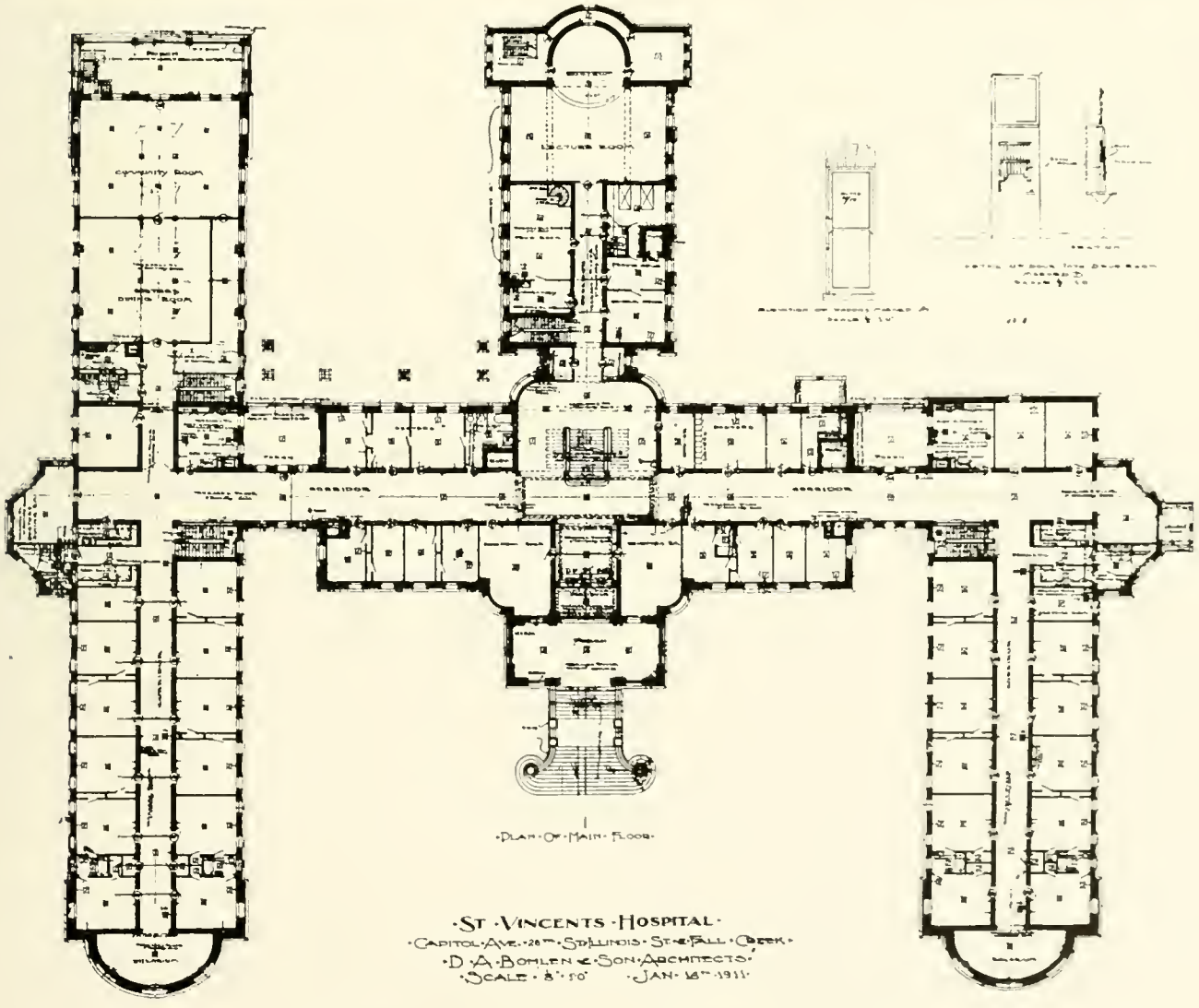
FIRST FLOOR PLAN



SECOND FLOOR PLAN



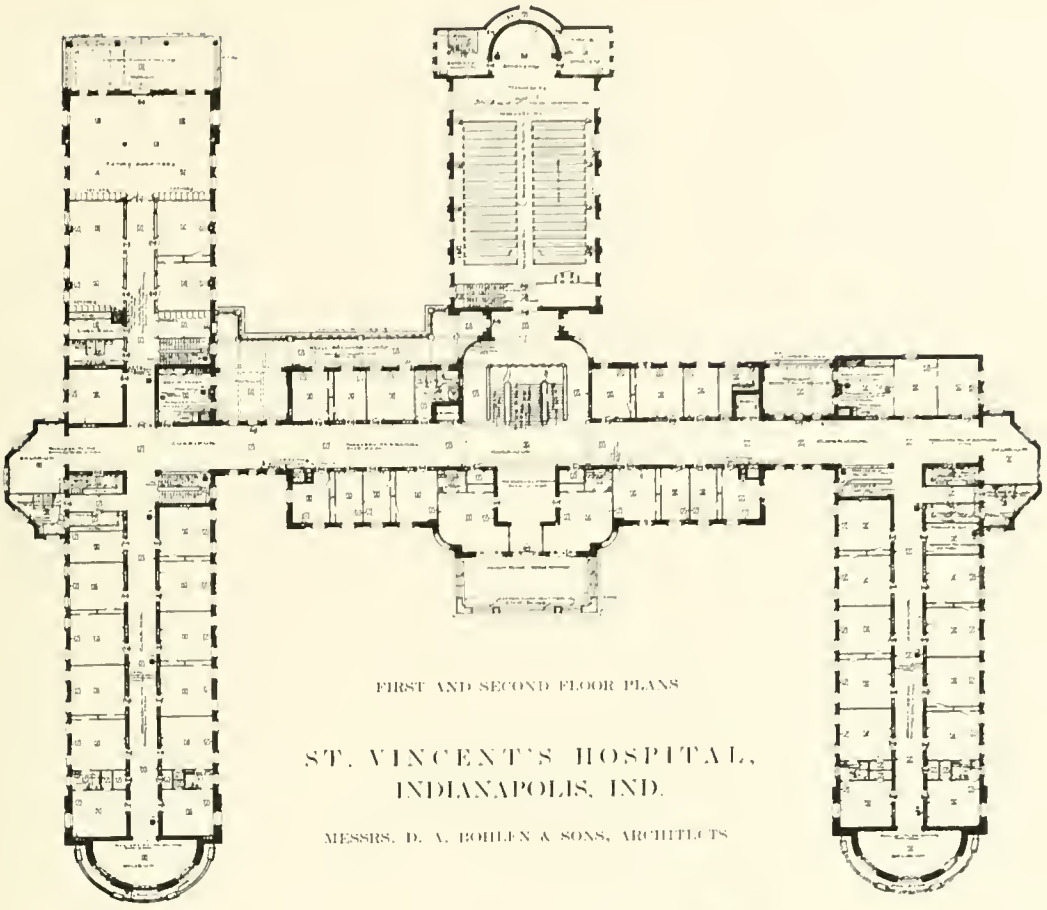
THIRD FLOOR PLAN


PLAN OF MAIN FLOOR
ST VINCENTS HOSPITAL
CAPITOL AVE. 28TH ST. INDIANA ST. FALL CREEK
D. A. BOHLEN & SON, ARCHITECTS
SCALE 8' 1'0" JAN. 16TH 1911

ST. VINCENT'S HOSPITAL, INDIANAPOLIS, IND.

MESSRS. D. A. BOHLEN & SONS, ARCHITECTS

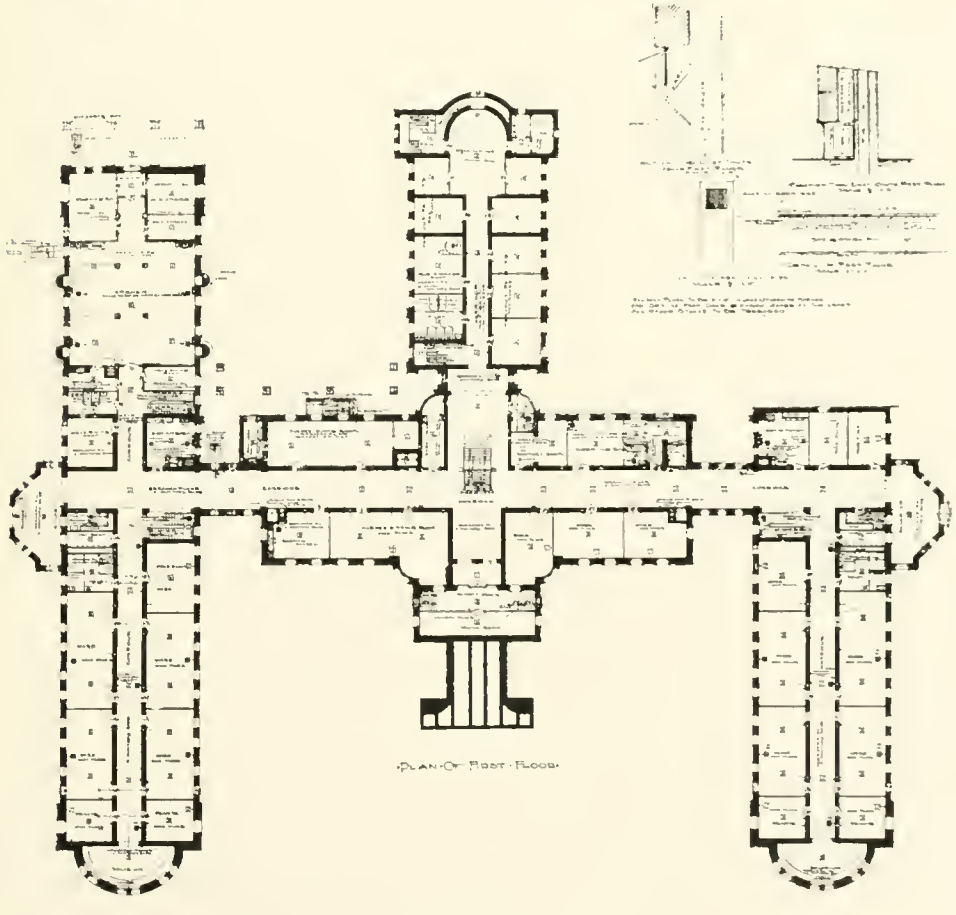
PLATE 32

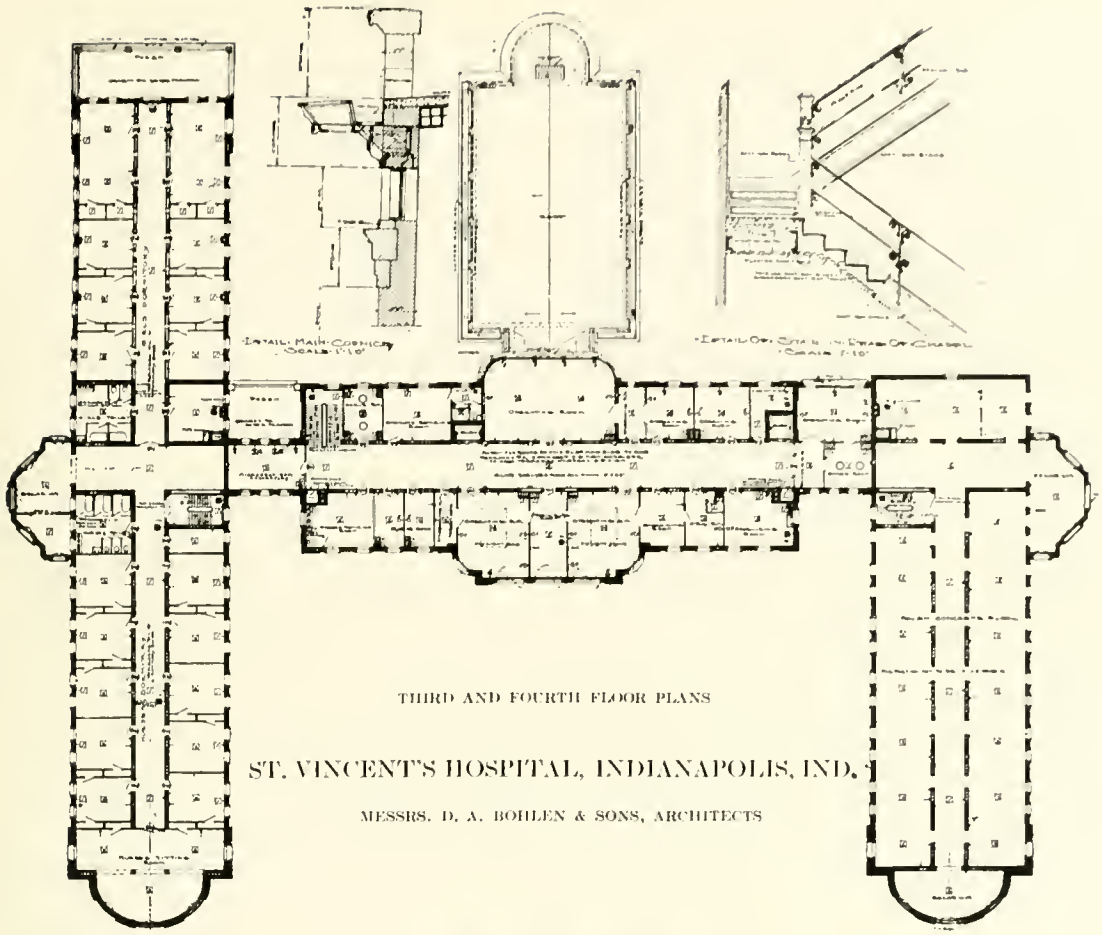


FIRST AND SECOND FLOOR PLANS

ST. VINCENT'S HOSPITAL,
INDIANAPOLIS, IND.

MESSRS. D. A. BOHLEN & SONS, ARCHITECTS

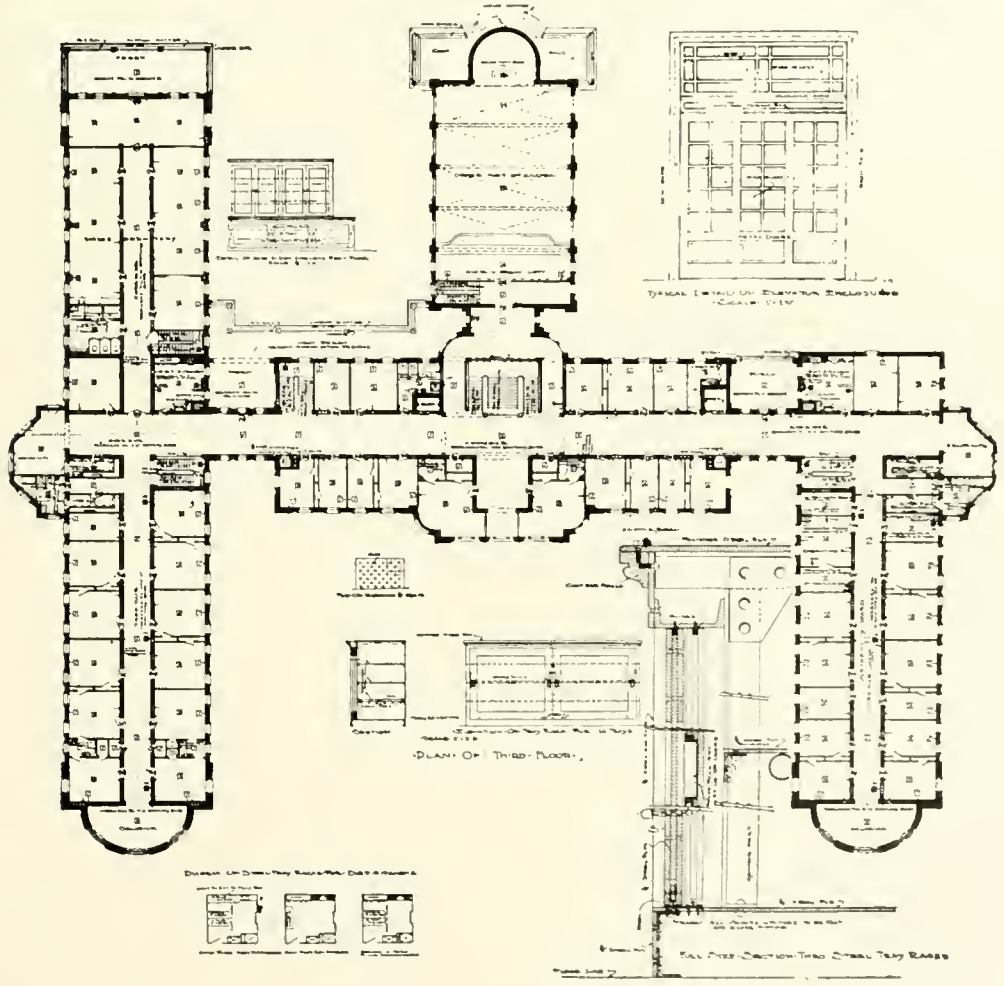


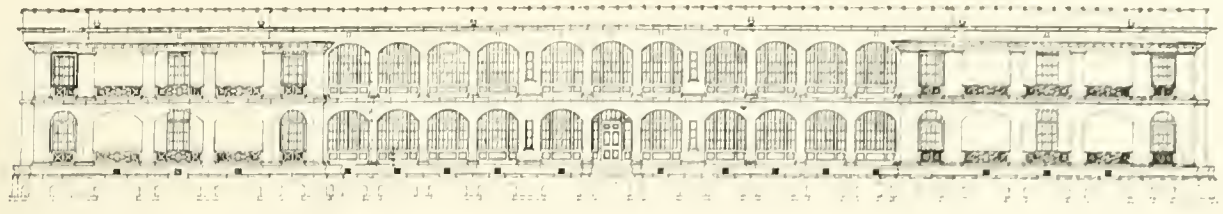


THIRD AND FOURTH FLOOR PLANS

ST. VINCENT'S HOSPITAL, INDIANAPOLIS, IND.

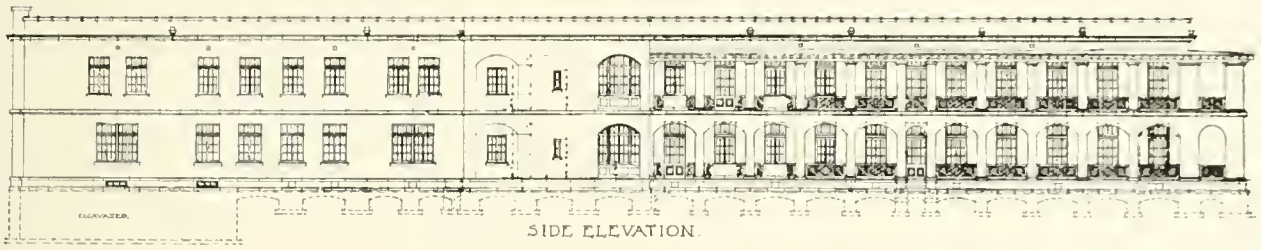
MESSRS. D. A. BOHLEN & SONS, ARCHITECTS



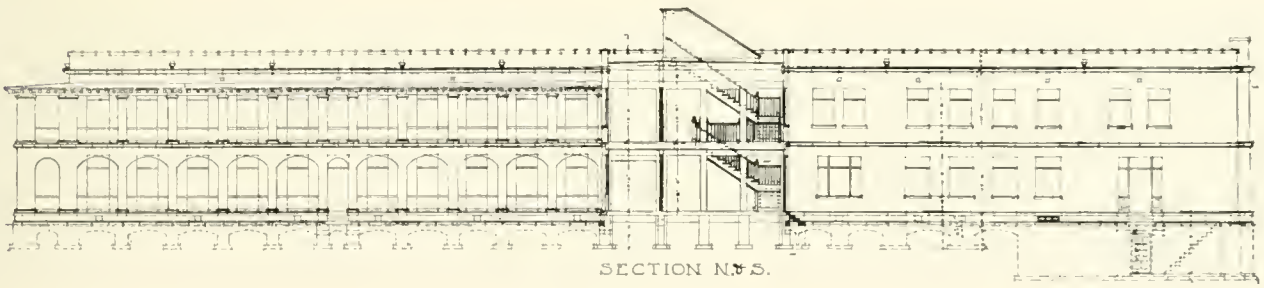


FRONT ELEVATION

REAR ELEVATION



SIDE ELEVATION.

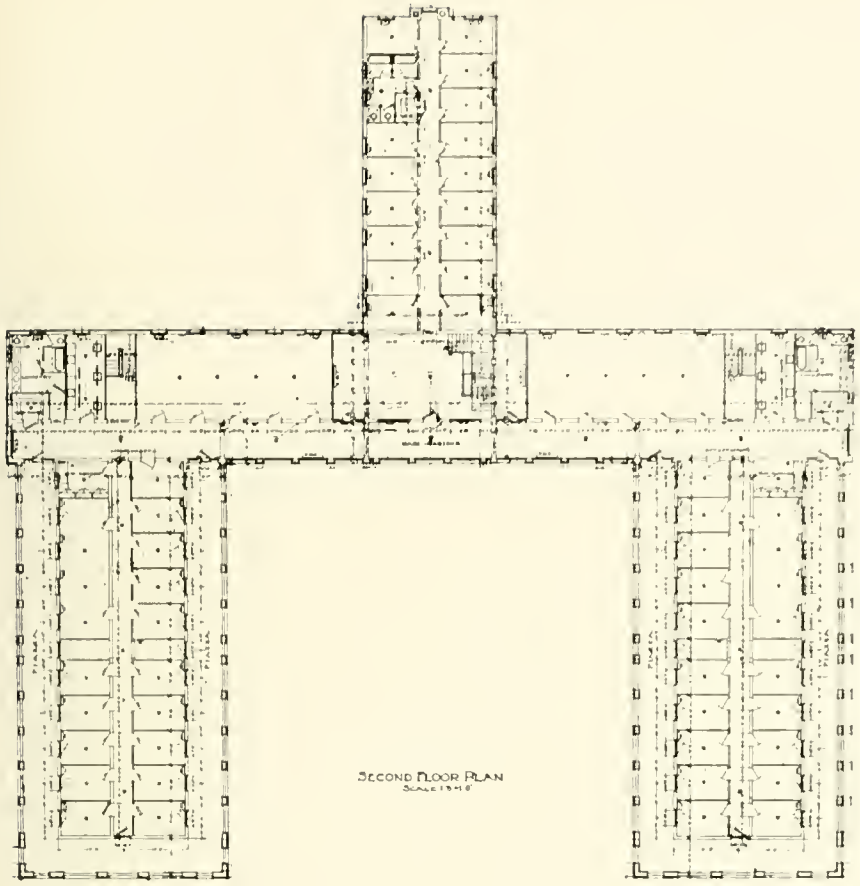


SECTION N. & S.

HOSPITAL BUILDING

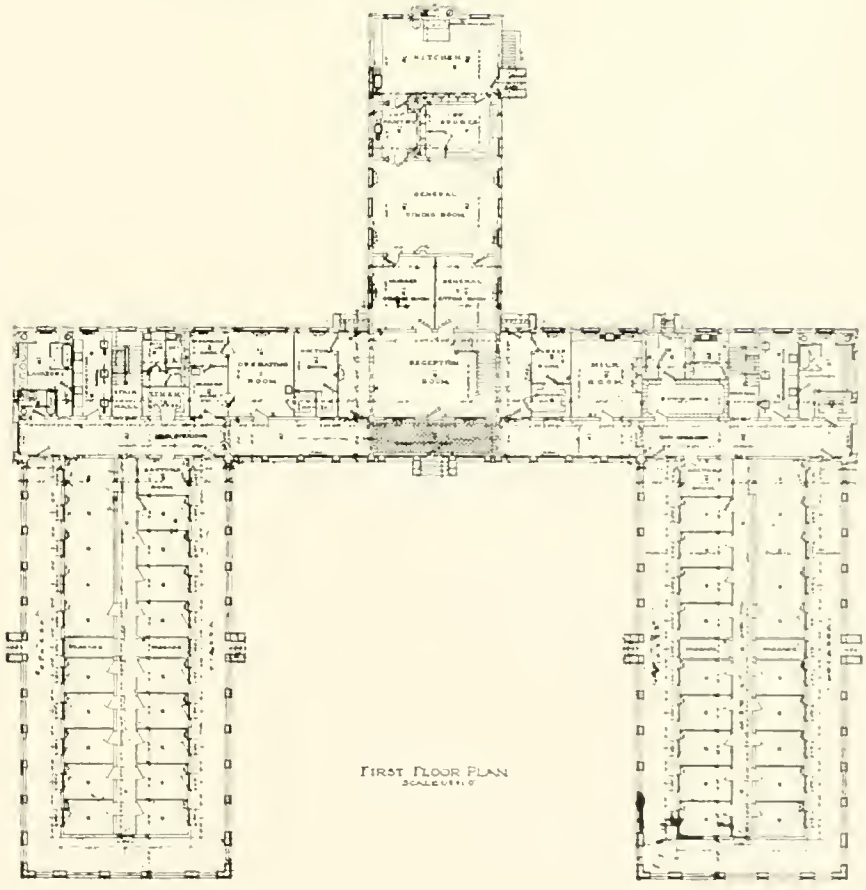
BROOKLYN CHILDREN'S AID SOCIETY SEASIDE HOME, CONEY ISLAND, N. Y.

MR. EDWARD PEARCE CASEY, ARCHITECT

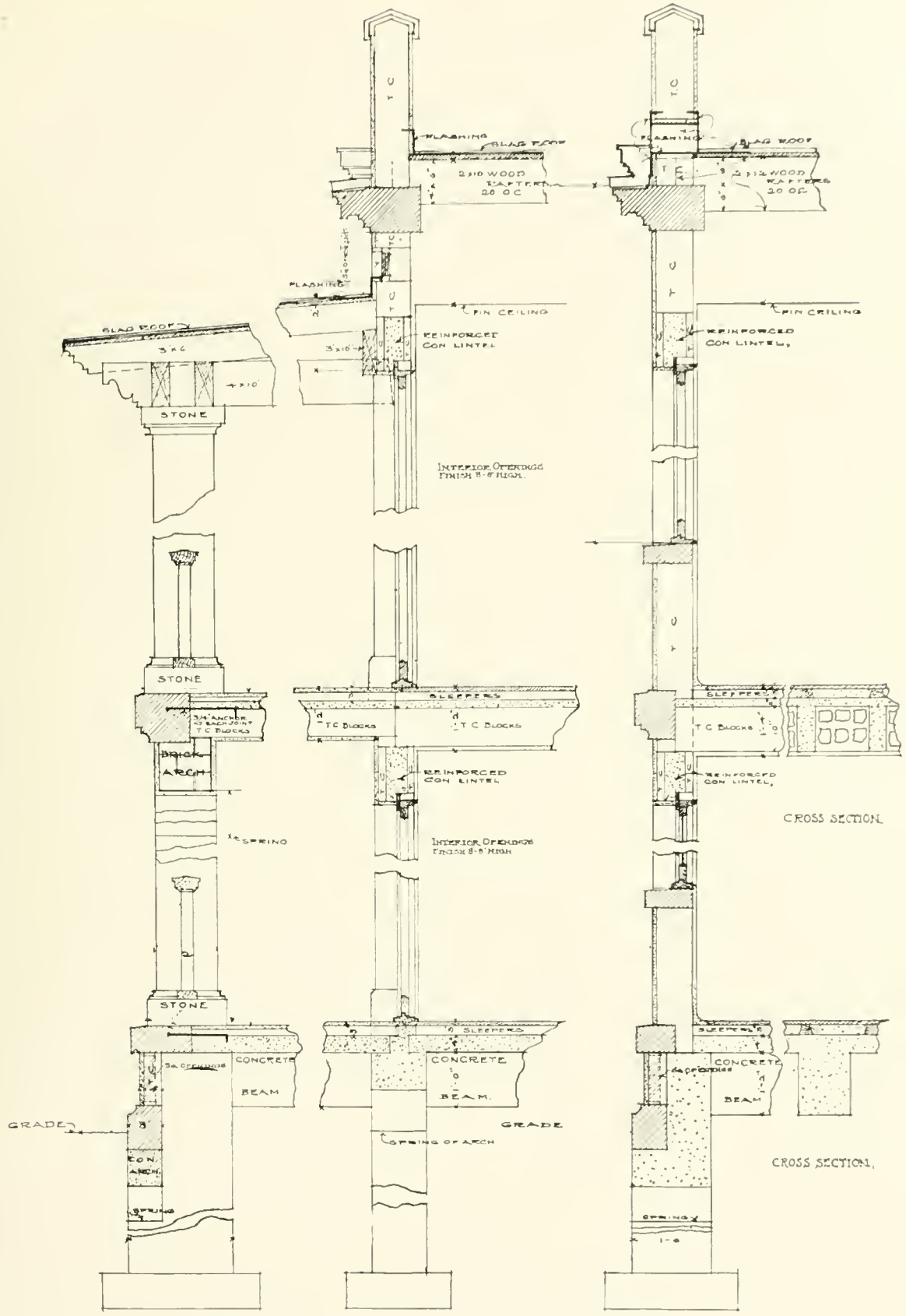


HOSPITAL BUILDING

BROOKLYN CHILDREN'S AID SOCIETY SEASIDE HOME, CONEY ISLAND, N.Y.



MR. EDWARD PEARCE CASEY, ARCHITECT



SECTION THROUGH PIAZZA ARCHES

SECTION THROUGH WALLS BACK OF PIAZZAS.

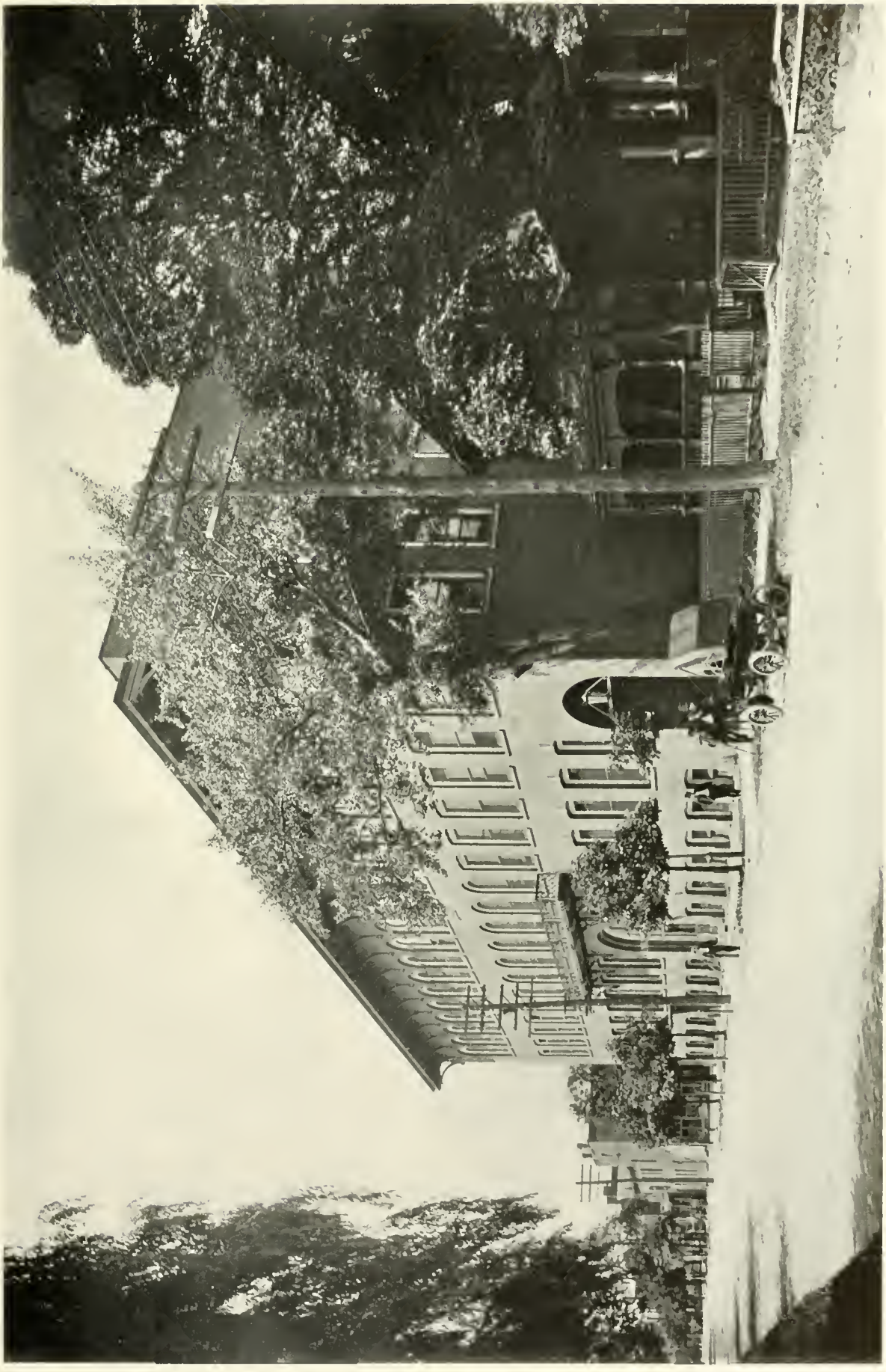
SECTION THROUGH REAR EXTENSION WALL.

SCALE 3/4" = 1'-0"

HOSPITAL BUILDING

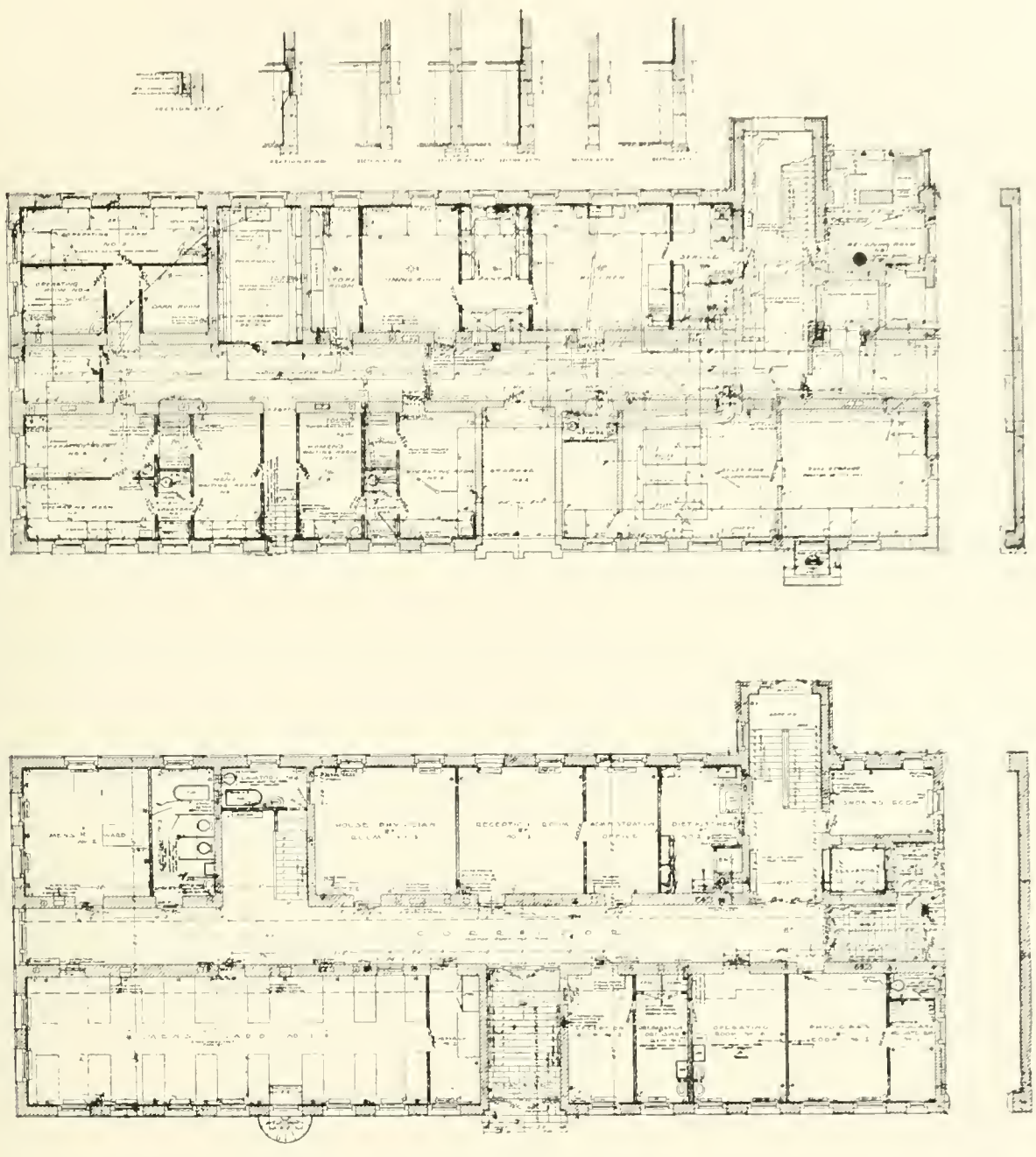
BROOKLYN CHILDREN'S AID SOCIETY SEASIDE HOME, CONEY ISLAND, N. Y.

MR. EDWARD PEARCE CASEY, ARCHITECT



EMERGENCY HOSPITAL, BUFFALO, N. Y.

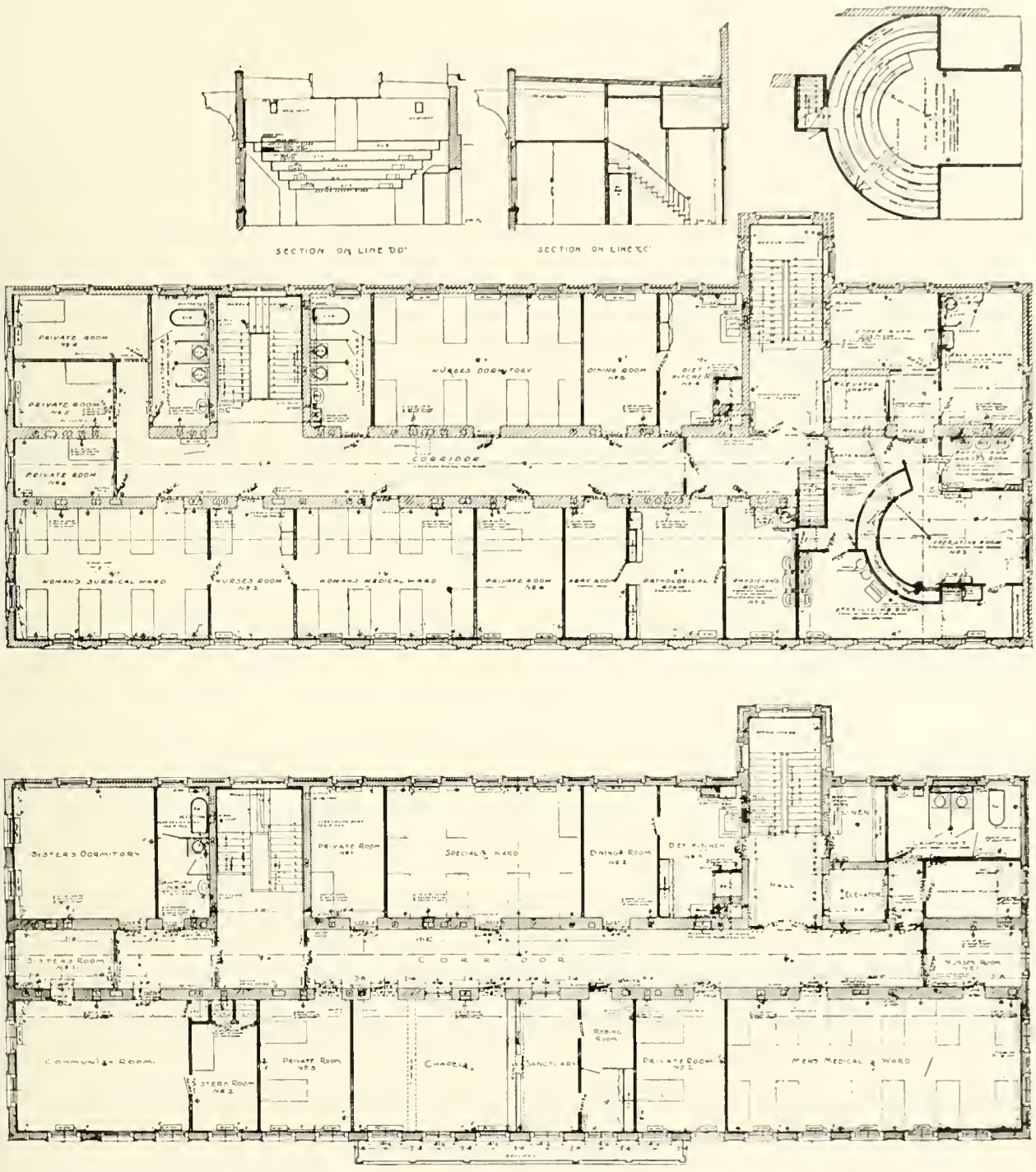
MESSRS. GREEN & WICKS, ARCHITECTS



BASEMENT AND FIRST FLOOR PLAN

EMERGENCY HOSPITAL, BUFFALO, N. Y.

MESSRS. GREEN & WICKS, ARCHITECTS



SECOND AND THIRD FLOOR PLANS

EMERGENCY HOSPITAL, BUFFALO, N. Y.

MESSRS. GREEN & WICKS, ARCHITECTS

WOMEN'S MEDICAL AND SURGICAL BUILDING, BRADFORD HOSPITAL, BRADFORD, PA.

MESSRS. GREEN & WICKS, ARCHITECTS

MEN'S MEDICAL AND SURGICAL BUILDING, BRADFORD HOSPITAL, BRADFORD, PA.

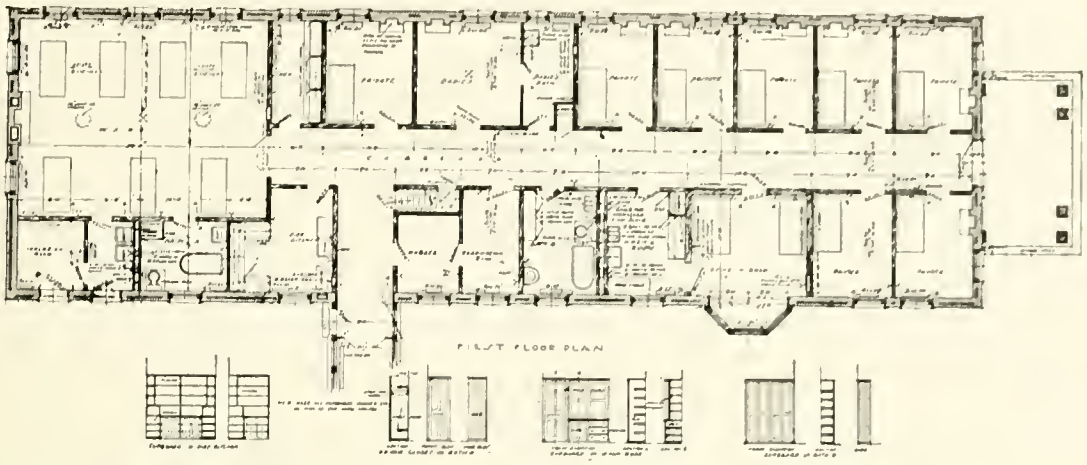
MESSRS. GREEN & WICKS, ARCHITECTS

MATERNITY BUILDING, BRADFORD HOSPITAL, BRADFORD, PA.

MESSRS. GREEN & WICKS, ARCHITECTS

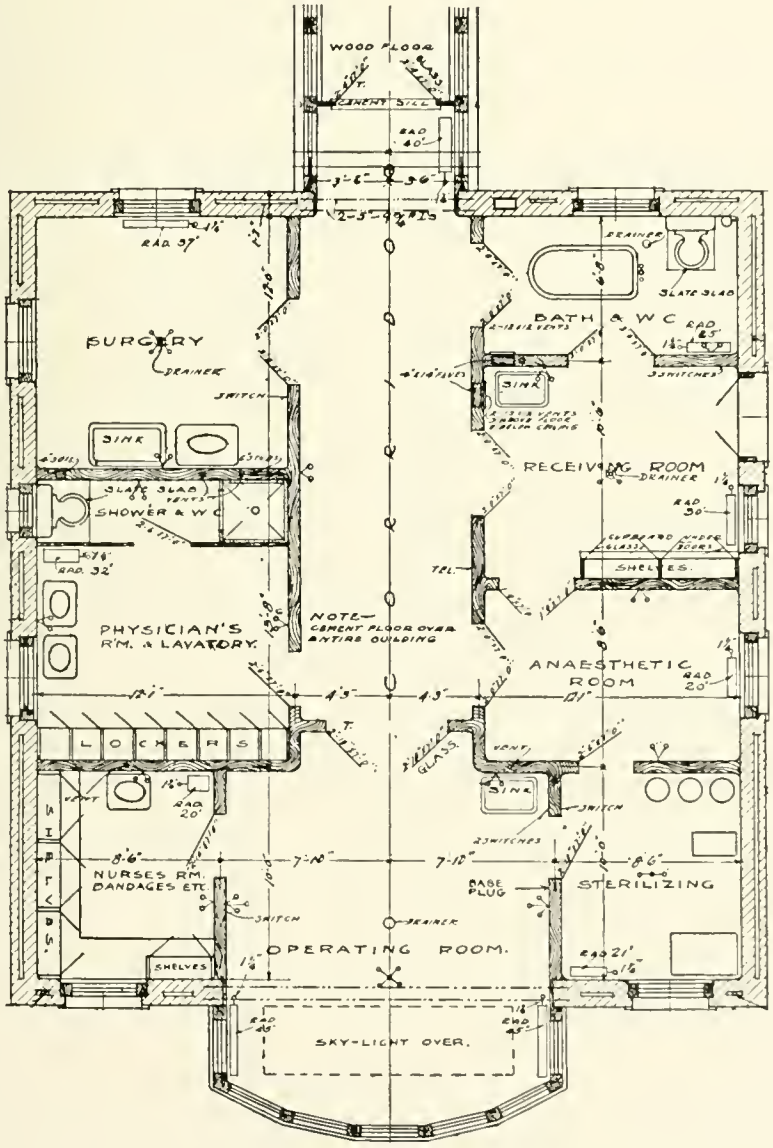
INTERIOR, WOMEN'S WARD, BRADFORD HOSPITAL, BRADFORD, PA.

MESSRS. GREEN & WICKS, ARCHITECT



MATERNITY BUILDING, BRADFORD HOSPITAL, BRADFORD, PA.

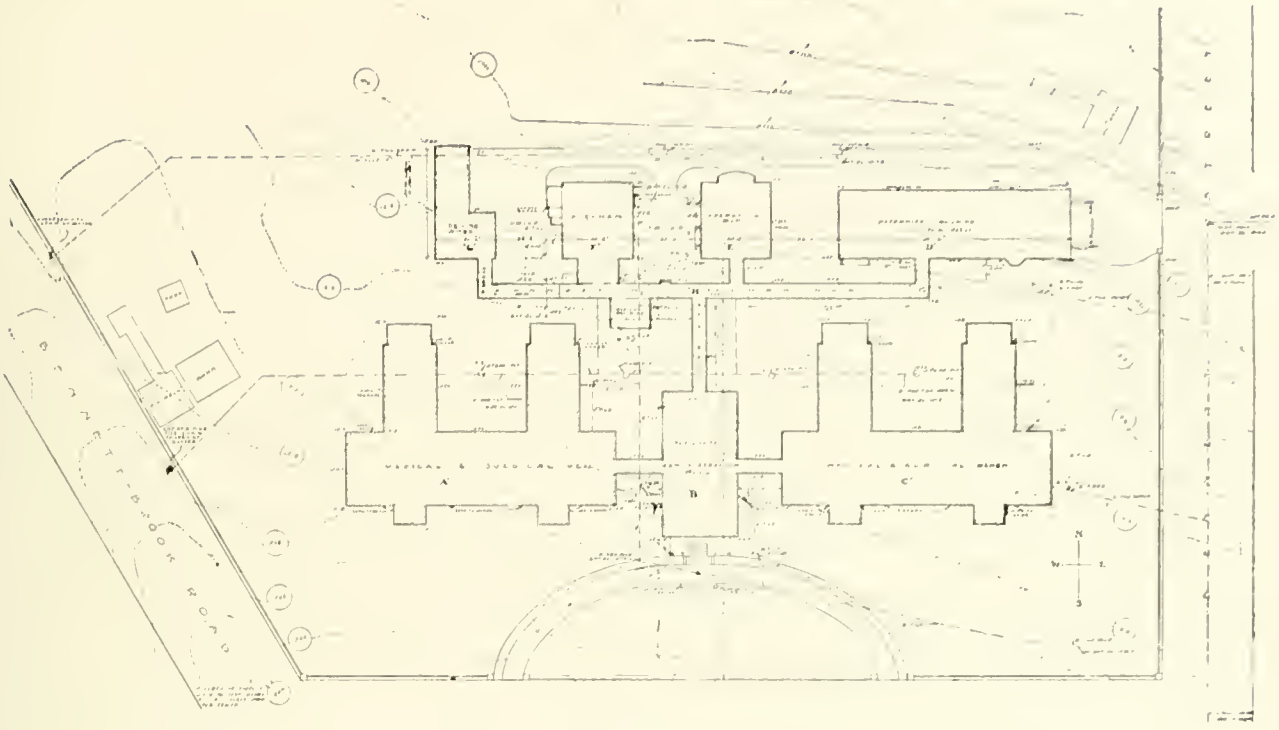
MESSRS. GREEN & WICKS, ARCHITECTS



FIRST FLOOR PLAN

OPERATING BUILDING, BRADFORD HOSPITAL, BRADFORD, PA.

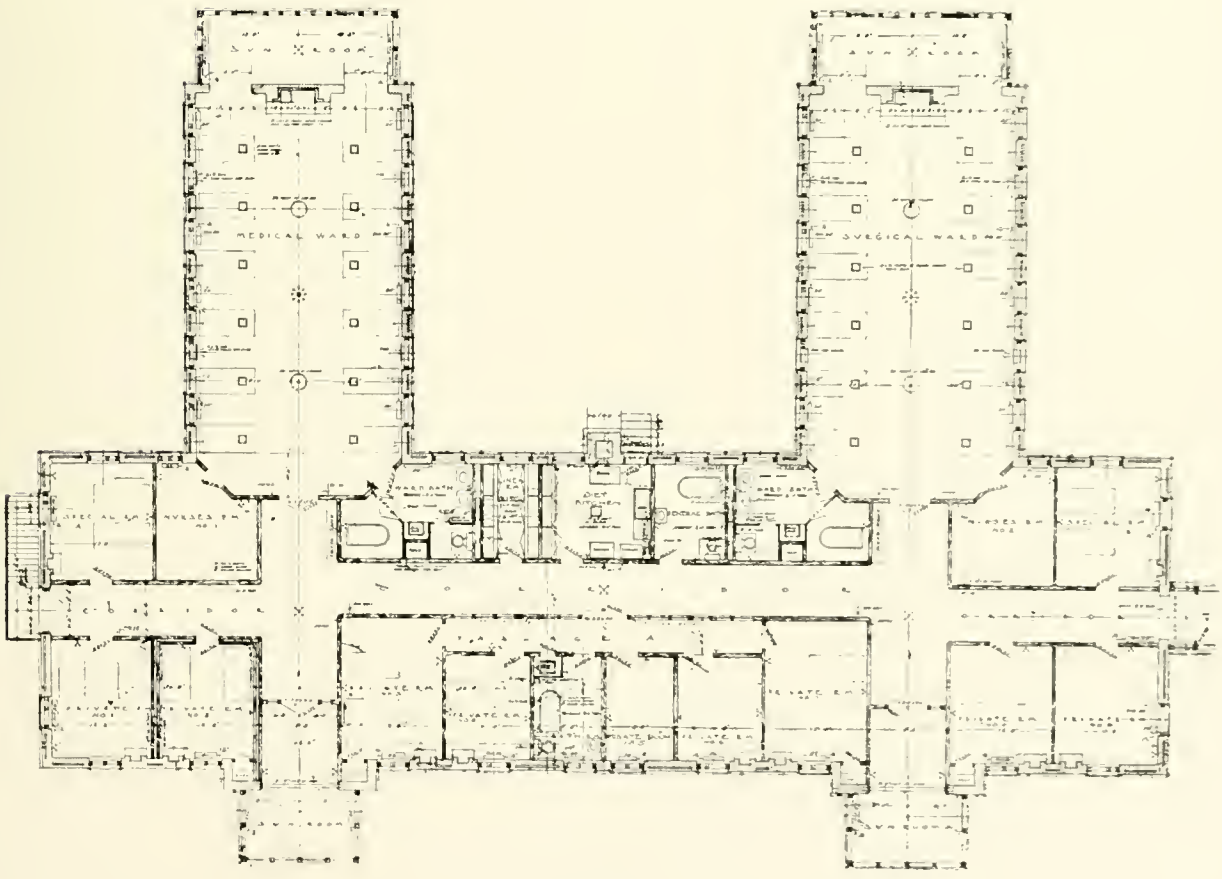
MESSRS. GREEN & WICKS, ARCHITECTS



PLOT PLAN

BRADFORD HOSPITAL, BRADFORD, PA.

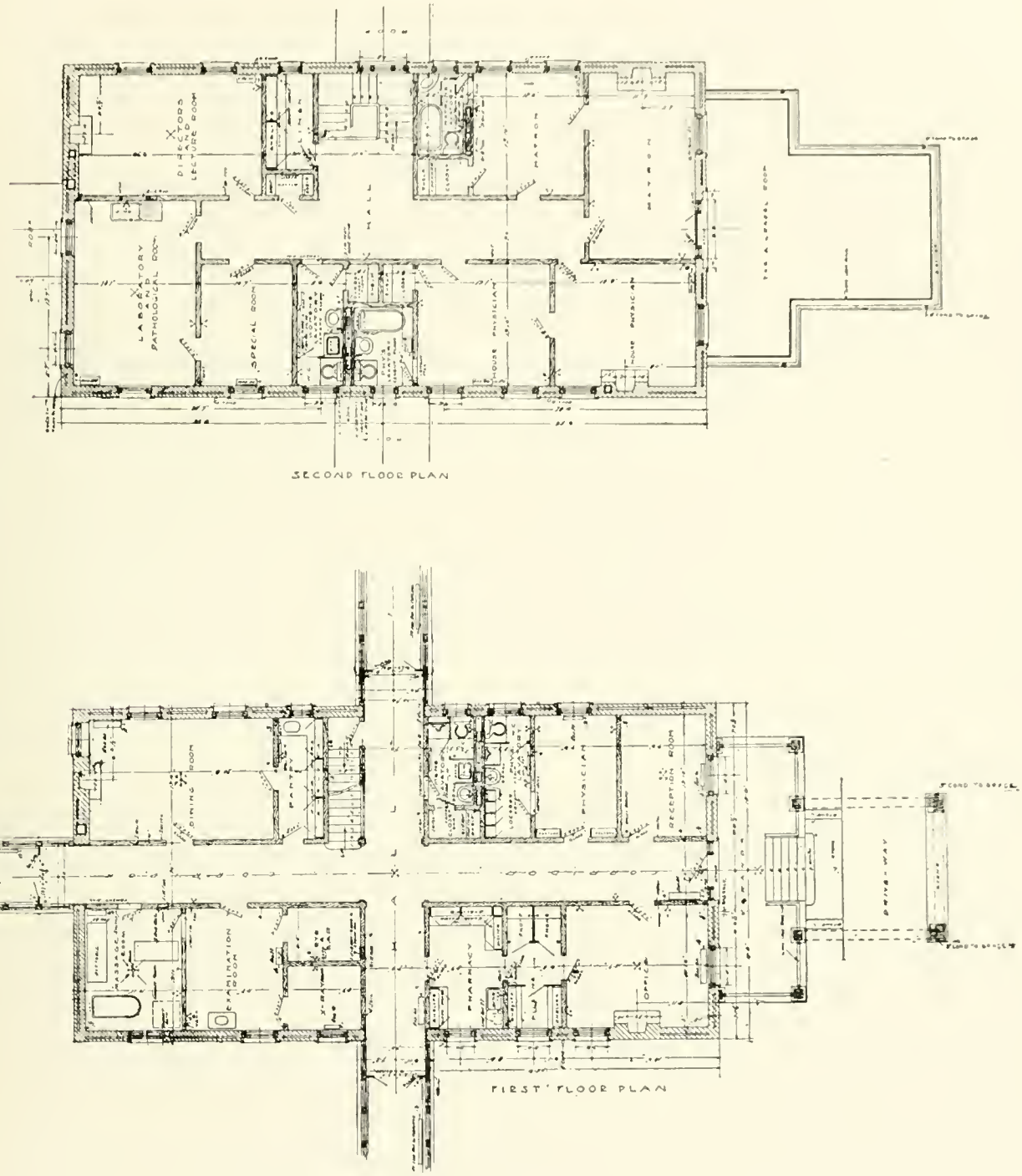
MESSRS. GREEN & WICKS, ARCHITECTS



FIRST FLOOR PLAN

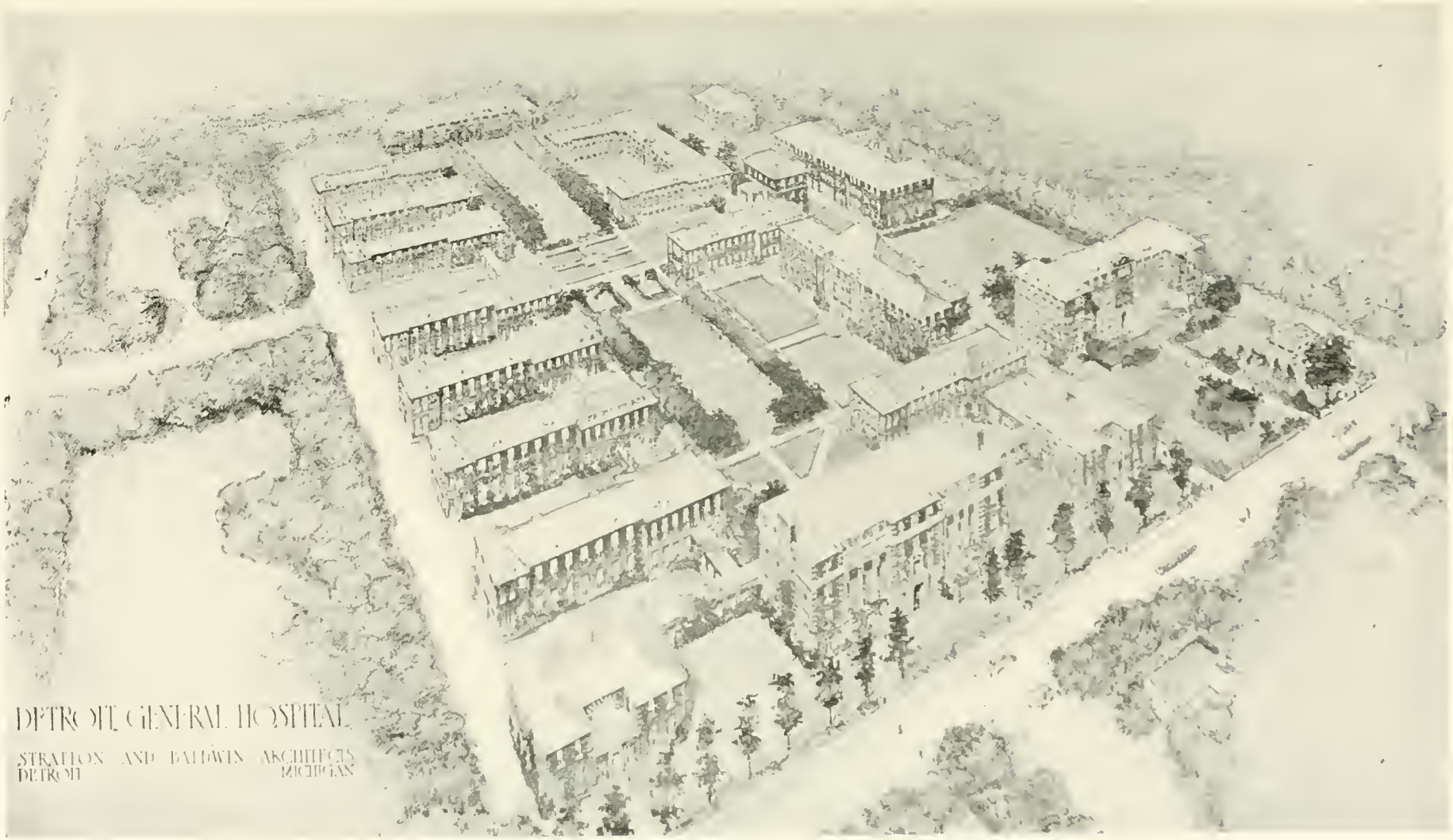
MEN'S MEDICAL AND SURGICAL BUILDING, BRADFORD HOSPITAL, BRADFORD, PA.

MESSRS. GREEN & WICKS, ARCHITECTS



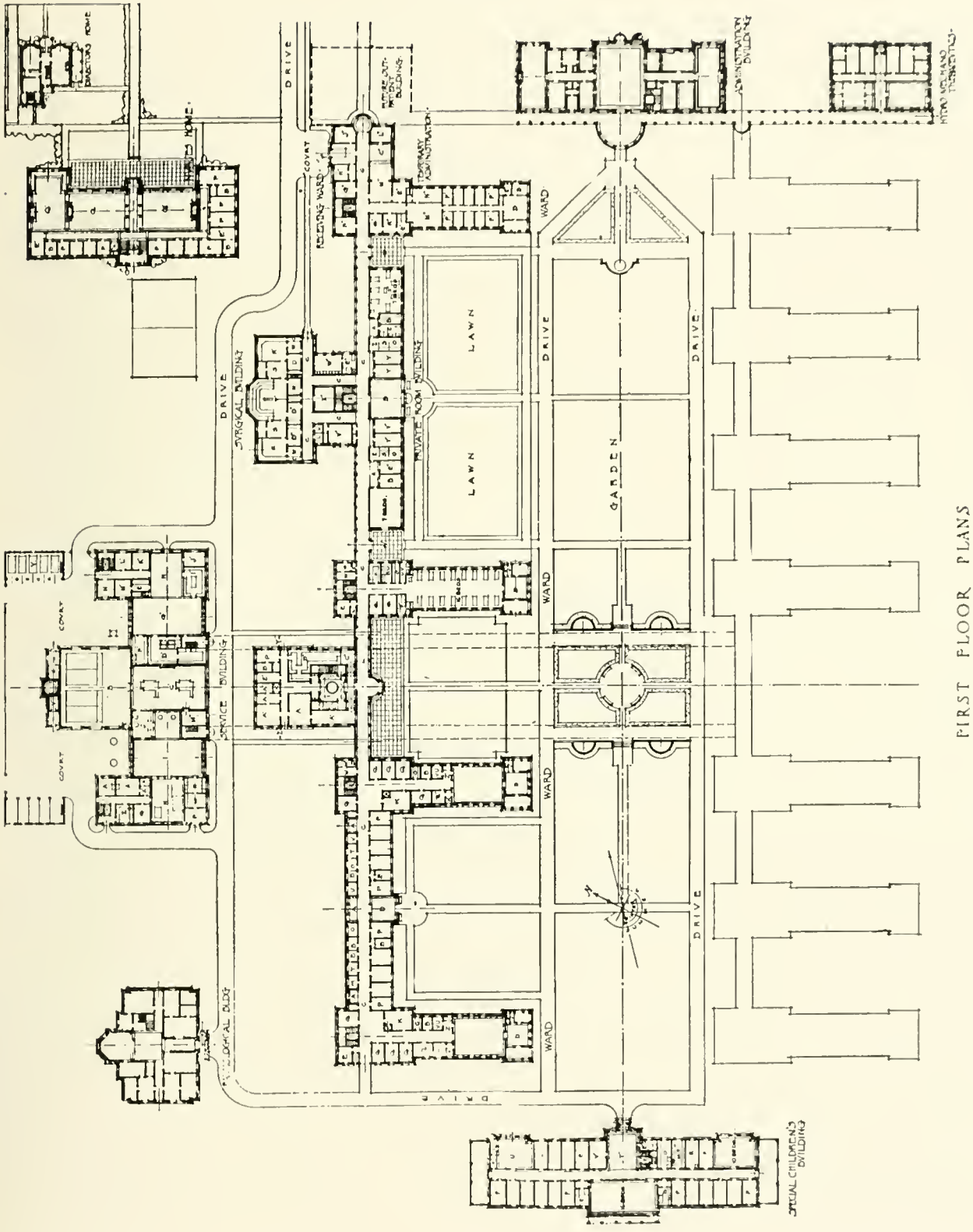
ADMINISTRATION BUILDING, BRADFORD HOSPITAL, BRADFORD, PA.

MESSRS. GREEN & WICKS, ARCHITECTS



DETROIT GENERAL HOSPITAL, DETROIT, MICH.

MESSRS. STRATTON & BALDWIN, ARCHITECTS

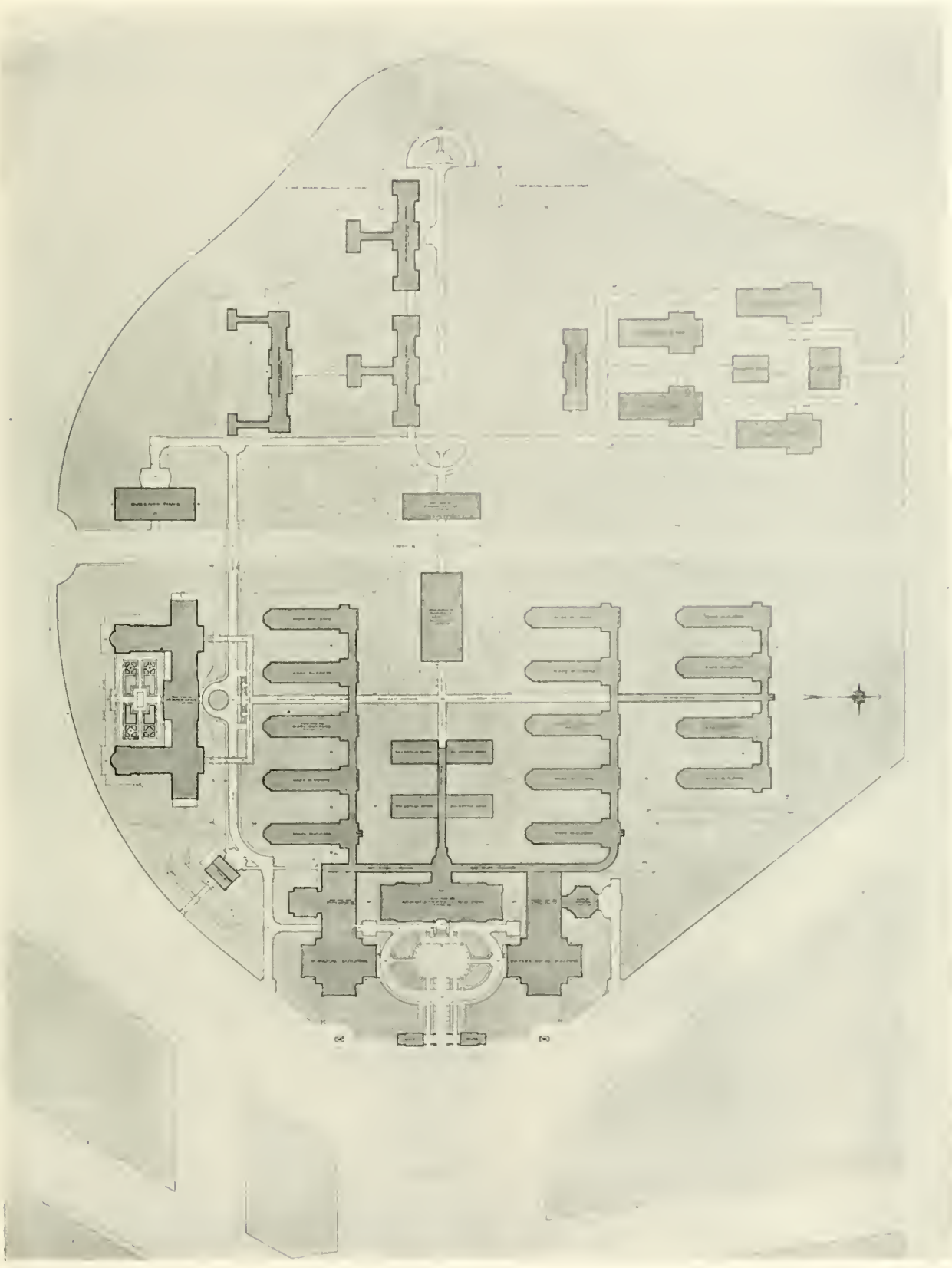


FIRST FLOOR PLANS

DETROIT GENERAL HOSPITAL, DETROIT, MICH.

MESSRS. STRATTON & BALDWIN, ARCHITECTS

PLATE 47



BLOCK PLAN

MUNICIPAL HOSPITAL FOR THE DISTRICT OF COLUMBIA

MESSRS. FRANK MILES DAY & BROTHER, ARCHITECTS

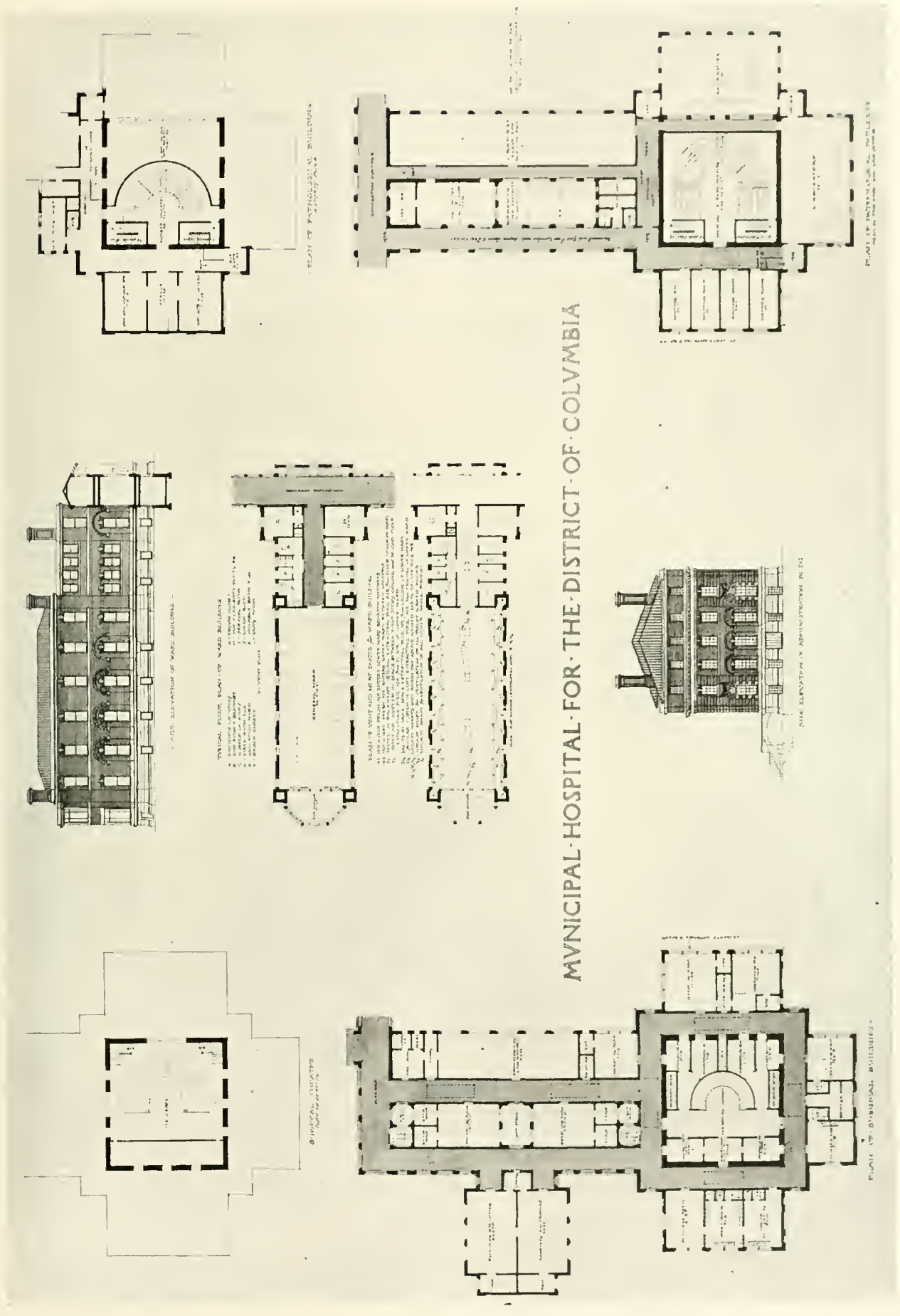
PLATE 48

SURGICAL BUILDING ADMINISTRATION BUILDING PATHOLOGICAL BUILDING

NURSES' HOME

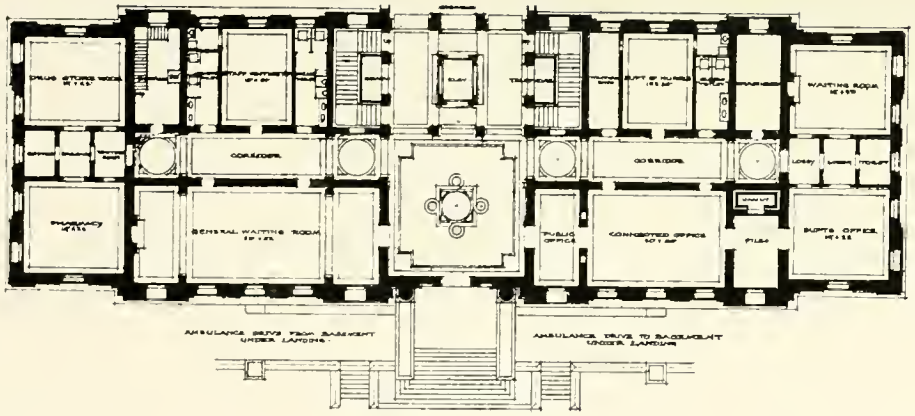
MUNICIPAL HOSPITAL FOR THE DISTRICT OF COLUMBIA

MESSRS. FRANK MILES DAY & BROTHER, ARCHITECTS

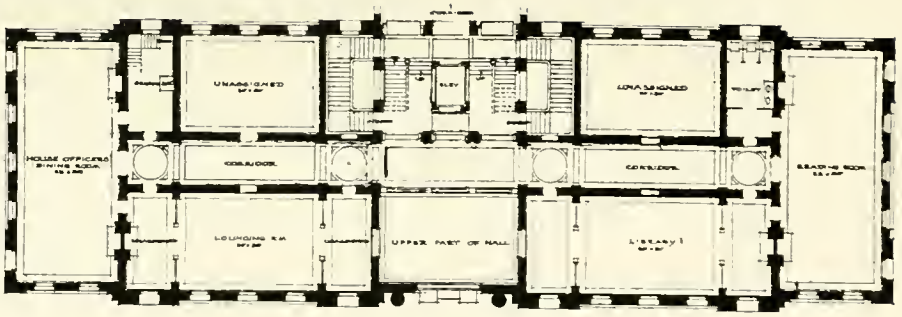


MESSRS. FRANK MILLS DAY & BROTHER, ARCHITECTS

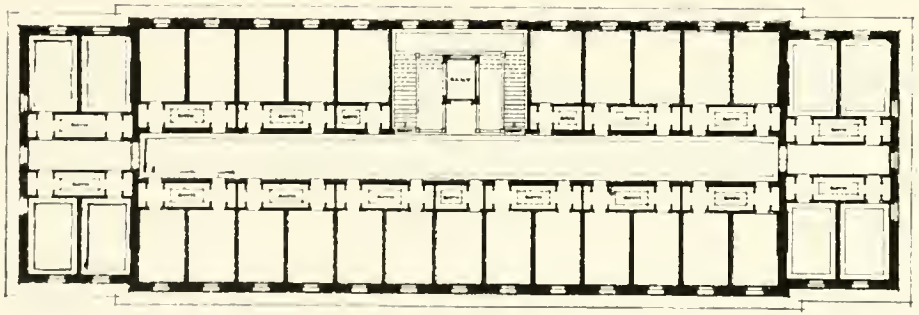
PLATE 30



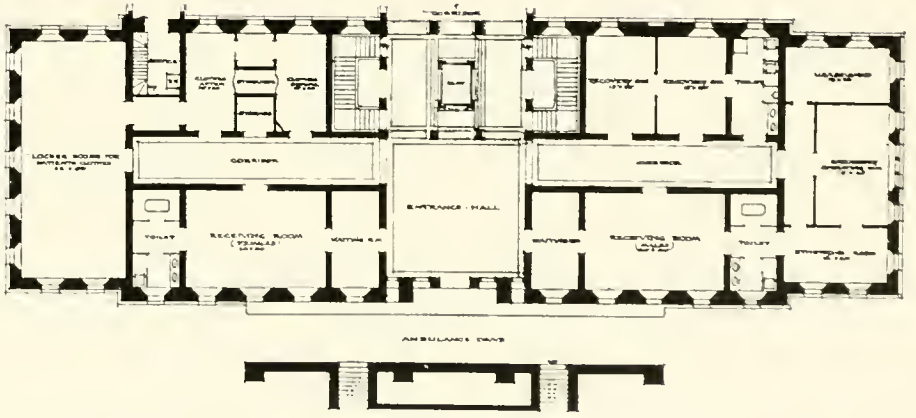
PLAN OF FIRST FLOOR



PLAN OF SECOND FLOOR



PLAN OF THIRD FLOOR
(HOUSE OFFICERS BED ROOMS)

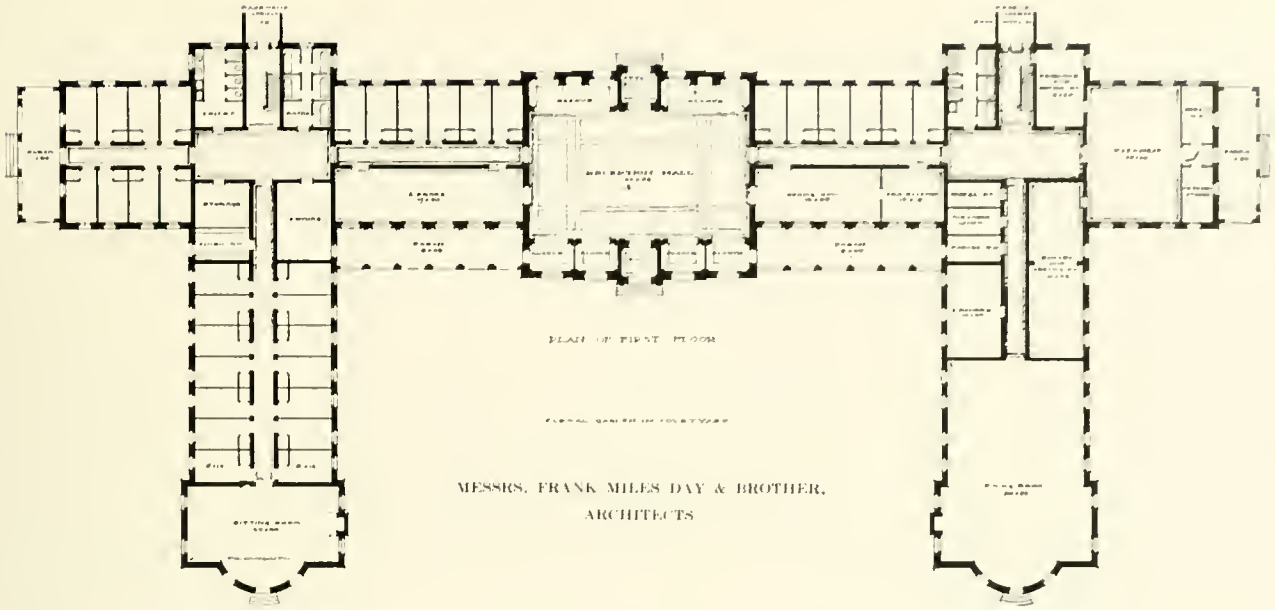


PLAN OF BASEMENT

FLOOR PLANS, ADMINISTRATION BUILDING

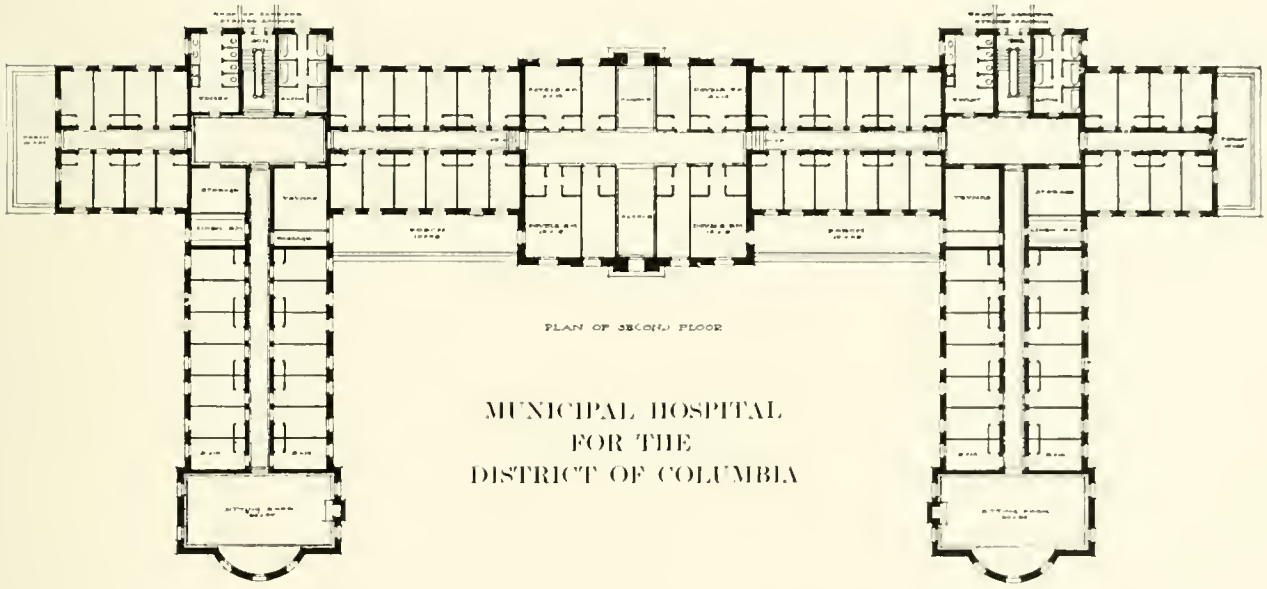
MUNICIPAL HOSPITAL FOR THE DISTRICT OF COLUMBIA

MESSRS. FRANK MILES DAY & BROTHER, ARCHITECTS



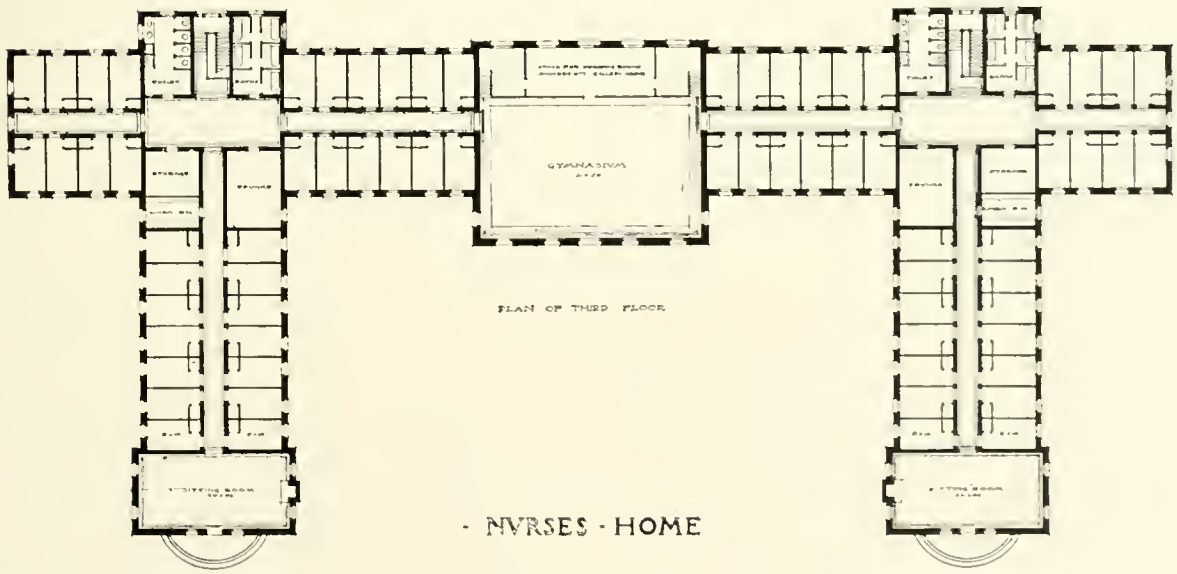
PLAN OF FIRST FLOOR

MESSRS. FRANK MILES DAY & BROTHER,
ARCHITECTS



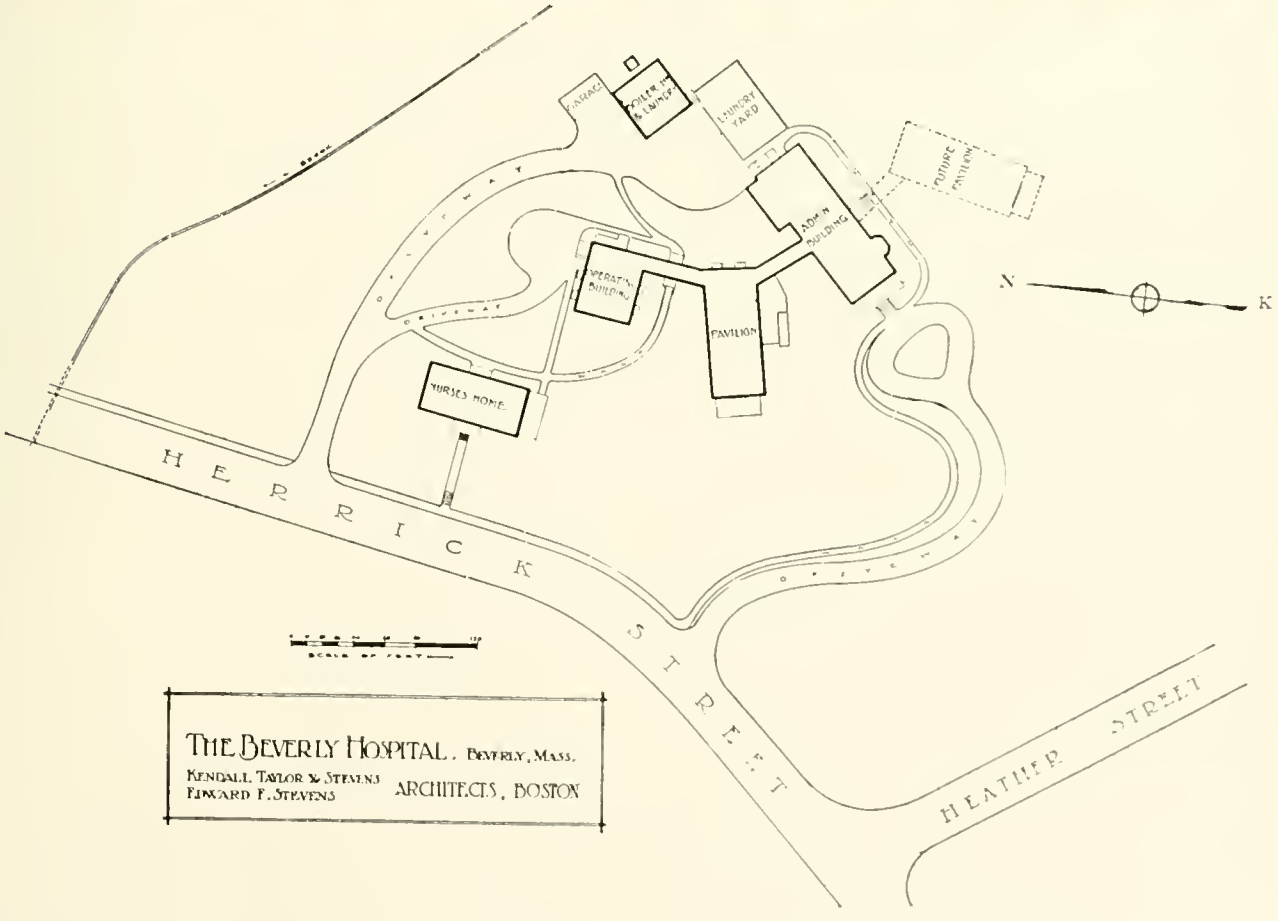
PLAN OF SECOND FLOOR

MUNICIPAL HOSPITAL
FOR THE
DISTRICT OF COLUMBIA



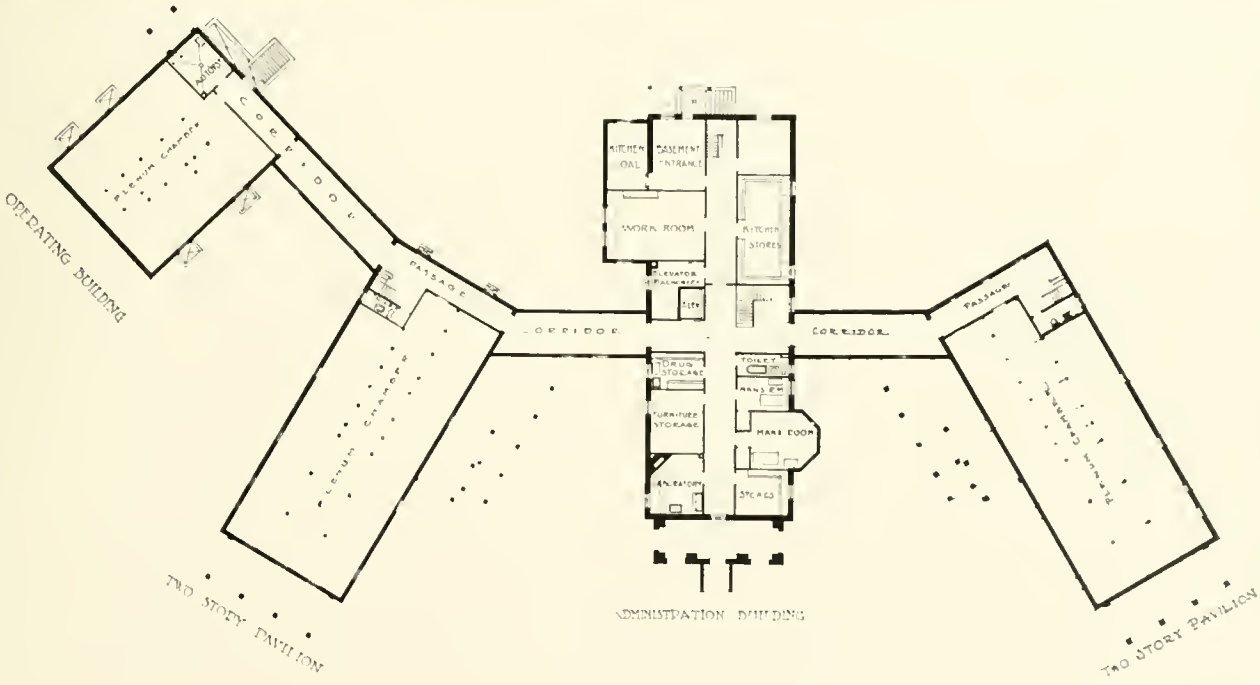
PLAN OF THIRD FLOOR

- NURSES - HOME



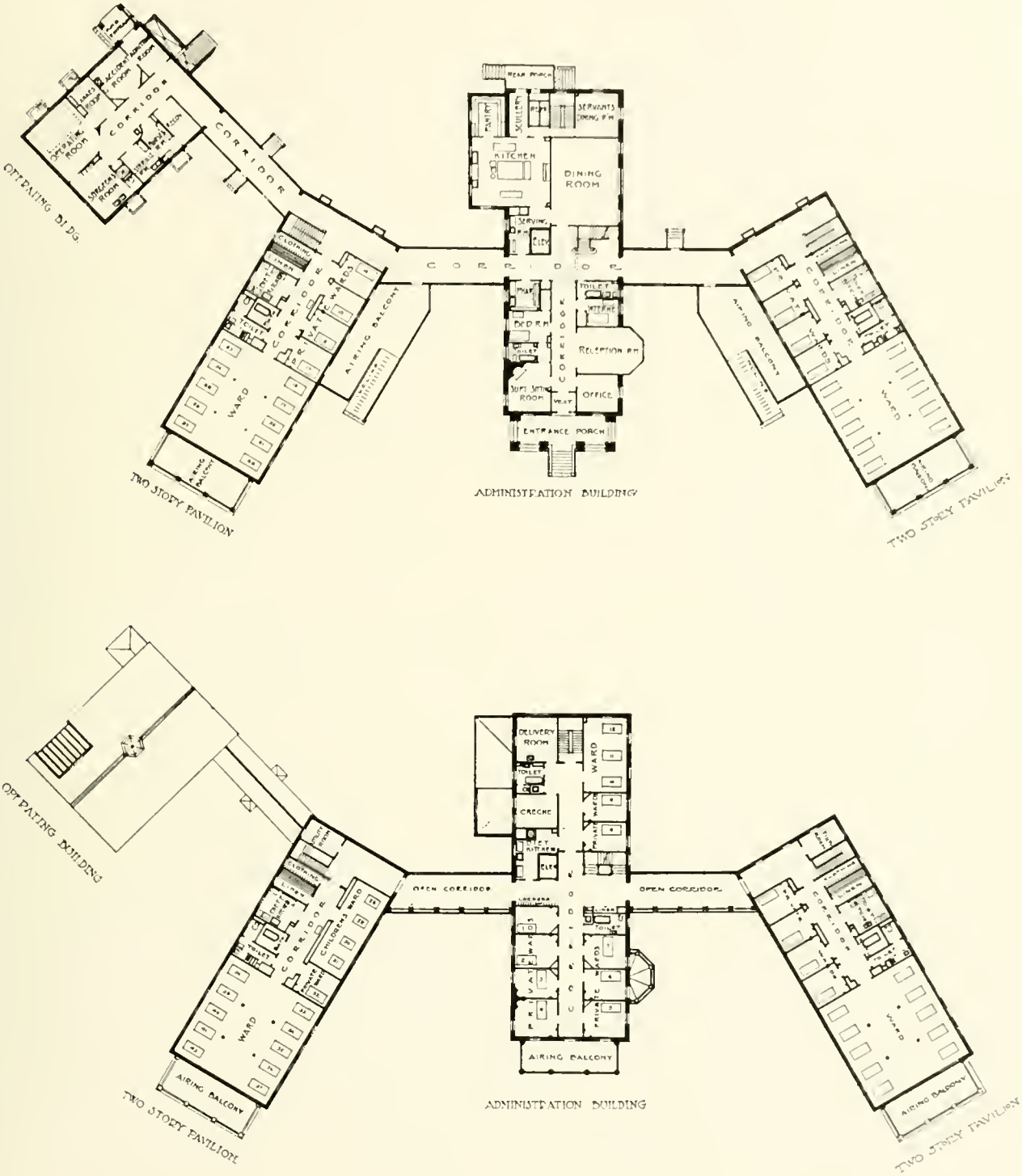
THE BEVERLY HOSPITAL, BEVERLY, MASS.
KENDALL, TAYLOR & STEVENS
EDWARD F. STEVENS ARCHITECTS, BOSTON

PLATE 53



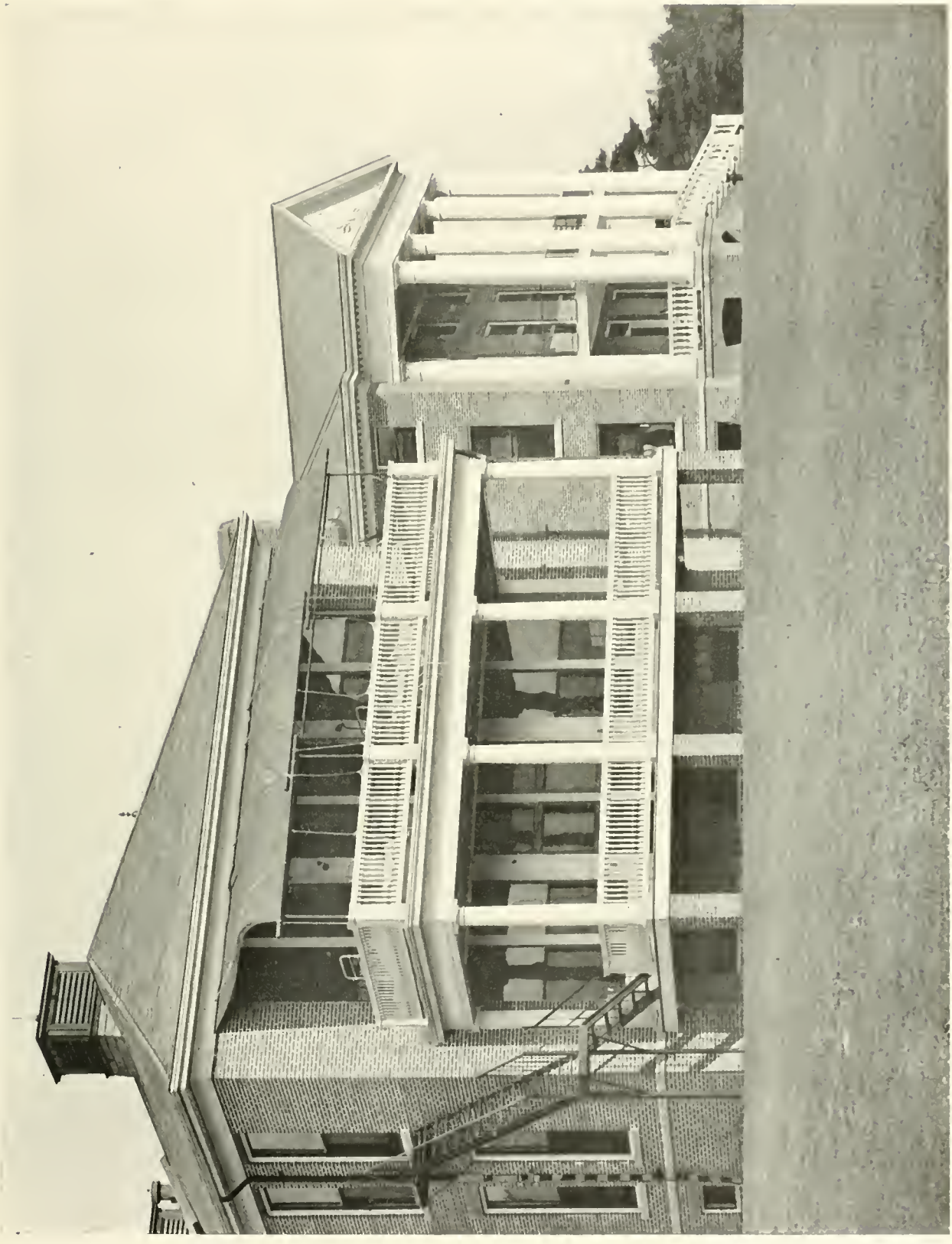
BEVERLY HOSPITAL, BEVERLY, MASS.

MR. EDWARD F. STEVENS, ARCHITECT.



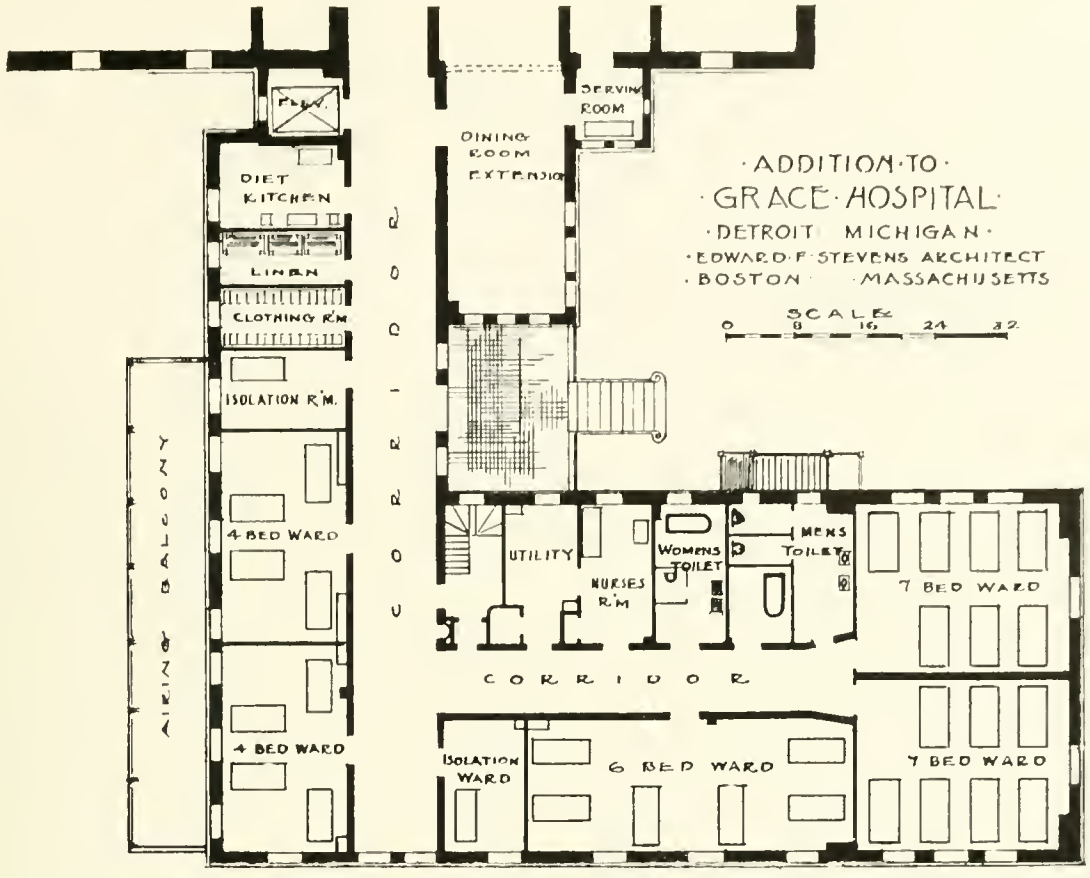
BEVERLY HOSPITAL, BEVERLY, MASS.

MR. EDWARD F. STEVENS, ARCHITECT.

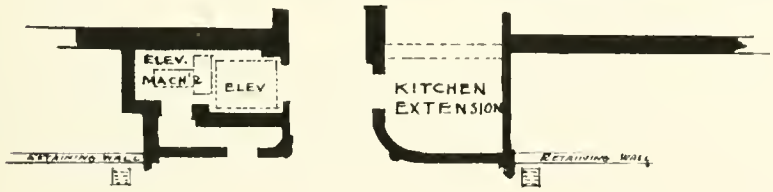


BEVERLY HOSPITAL, BEVERLY, MASS.

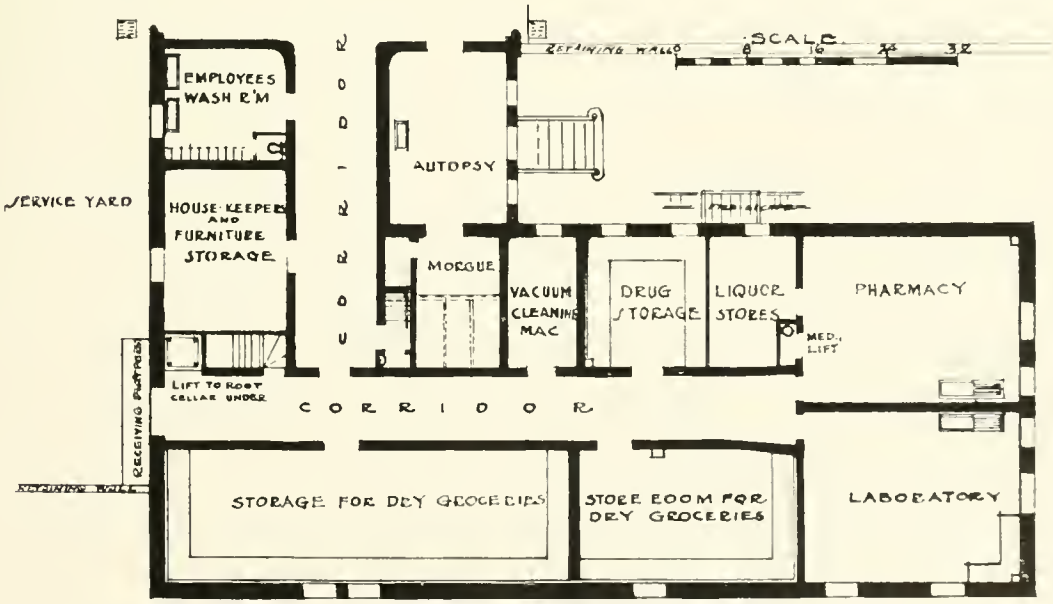
MR. EDWARD F. STEARNS, ARCHITECT.



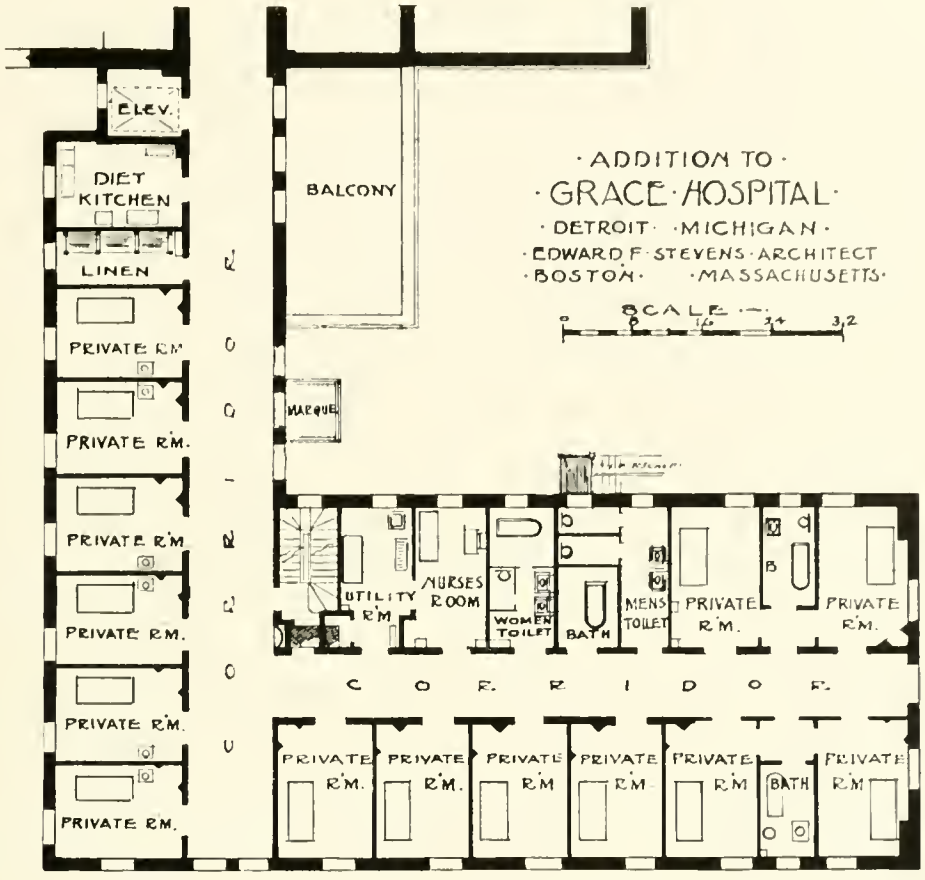
PLAN OF FIRST FLOOR



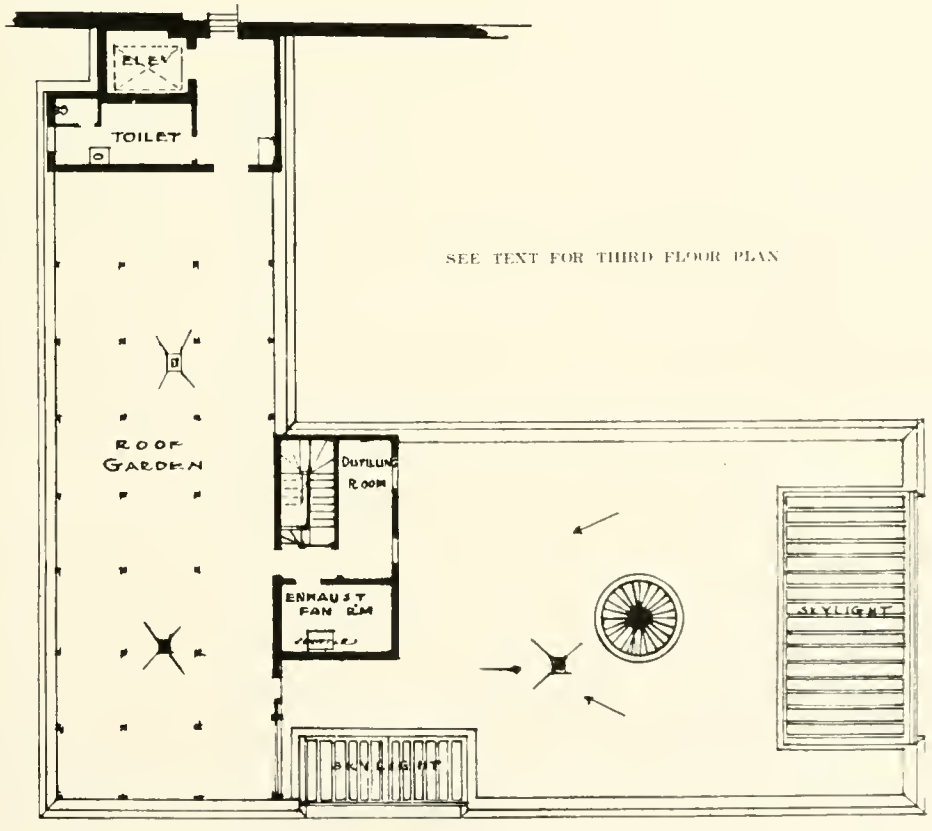
MAIN DRIVE



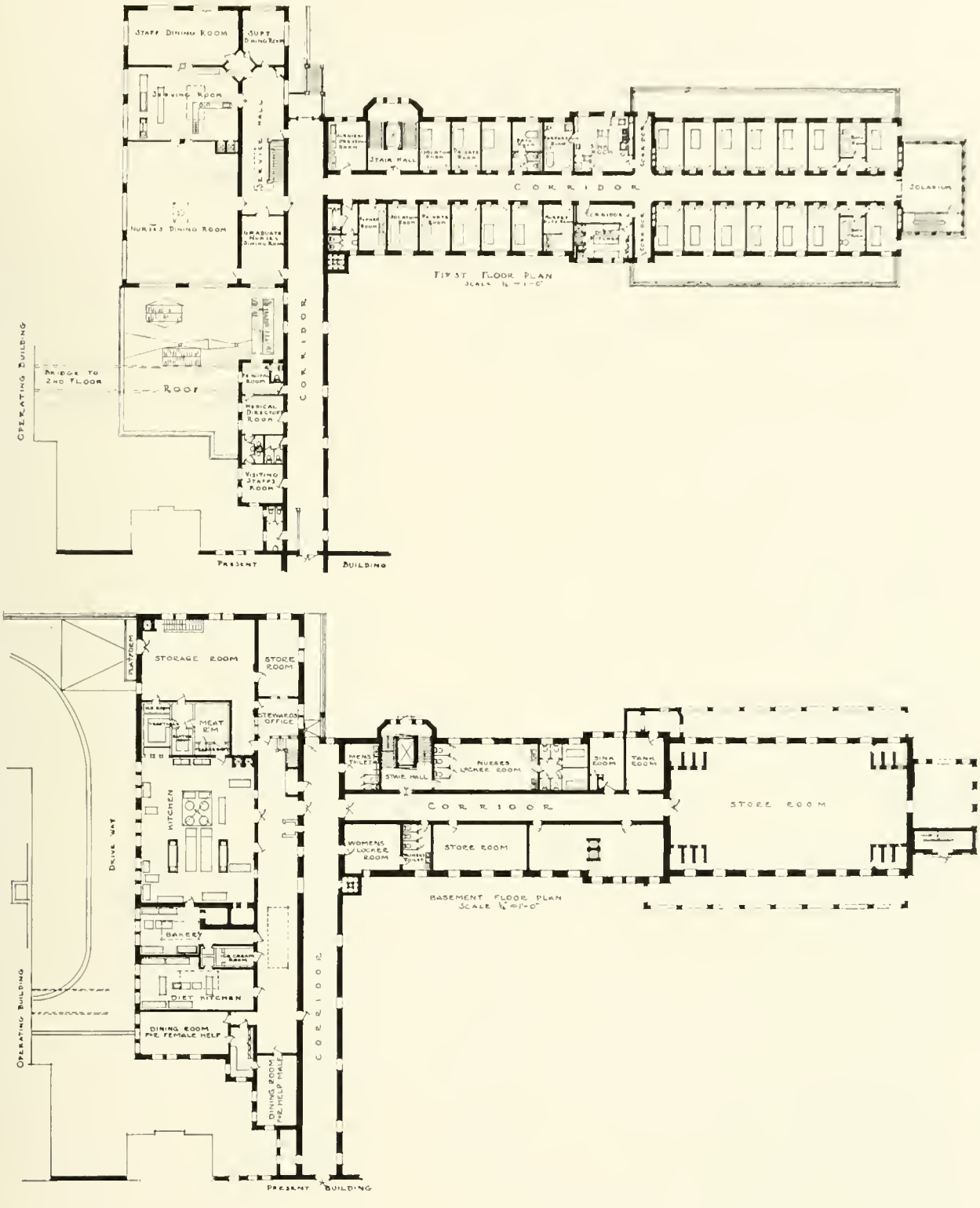
PLAN OF BASEMENT FLOOR



·PLAN·OF·SECOND·FLOOR·



·PLAN·OF· ROOF·



HARPER HOSPITAL, DETROIT, MICH.

MESSRS. MALCOMSON & HIGGINBOTHAM, ARCHITECTS.
MR. EDWARD F. STEVENS, CONSULTING ARCHITECT.

ORIGINAL PERSPECTIVE SKETCH

COMPLETED WORK

STATE ASYLUM FOR THE CHRONIC INSANE, WERNERSVILLE, PA.

MESSRS. RANKIN, KELLOGG & CRANE, ARCHITECTS

MAIN BUILDING

STATE ASYLUM FOR THE CHRONIC INSANE, WERNERSVILLE, PA.

MESSRS. RANKIN, KELLOGG & CRANE, ARCHITECTS

STATE ASYLUM FOR THE CHRONIC INSANE, WERNERSVILLE, PA.

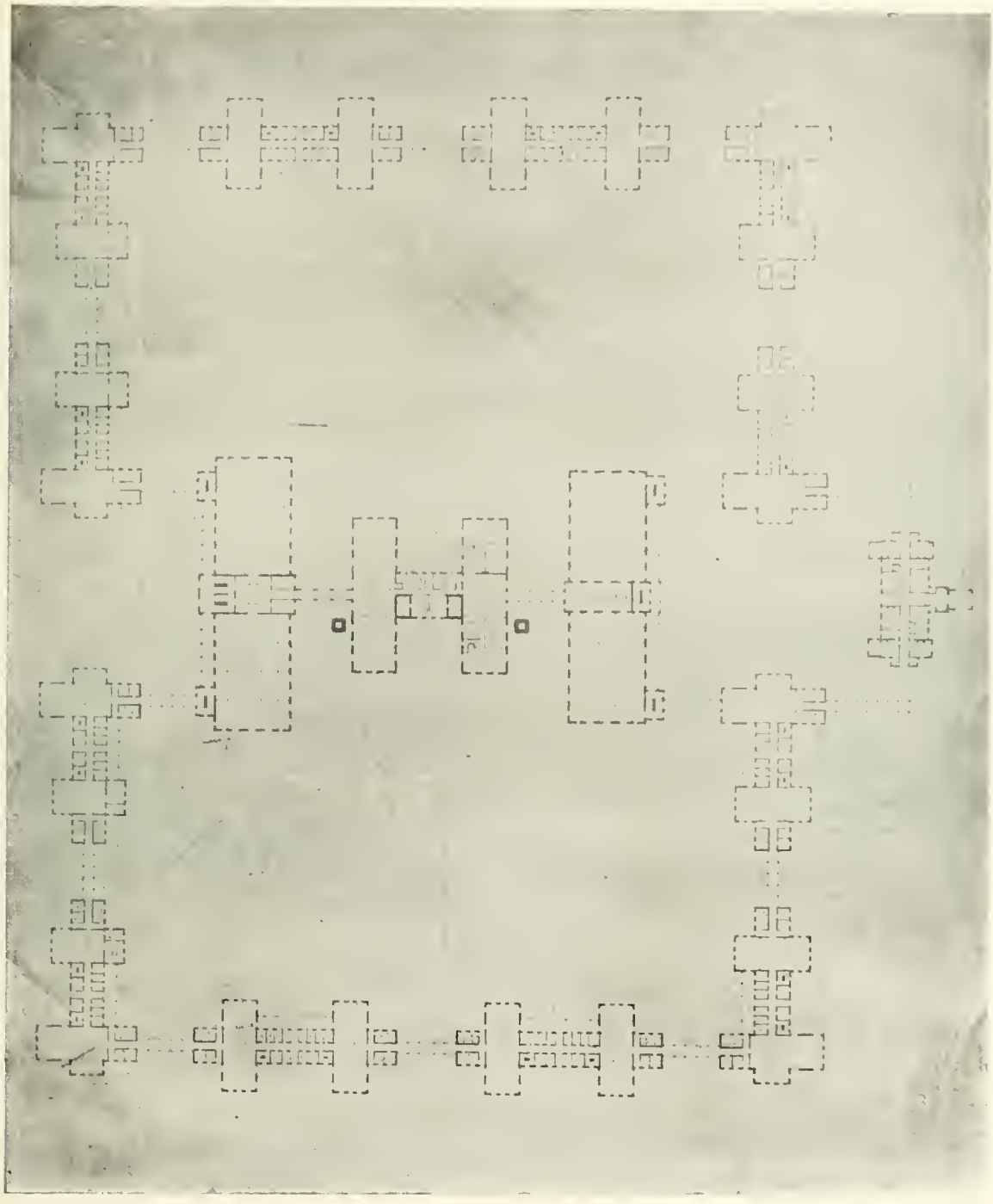
COURT VIEW

MESSRS. RANKIN, KELLOGG & CRANE, ARCHITECTS

STATE ASYLUM FOR THE CHRONIC INSANE, WERNERSVILLE, PA.

MESSRS. RANKIN, KELLOGG & CRANE, ARCHITECTS

PLATE 63



GENERAL PLAN

STATE ASYLUM FOR THE CHRONIC INSANE, WERNERSVILLE, PA.

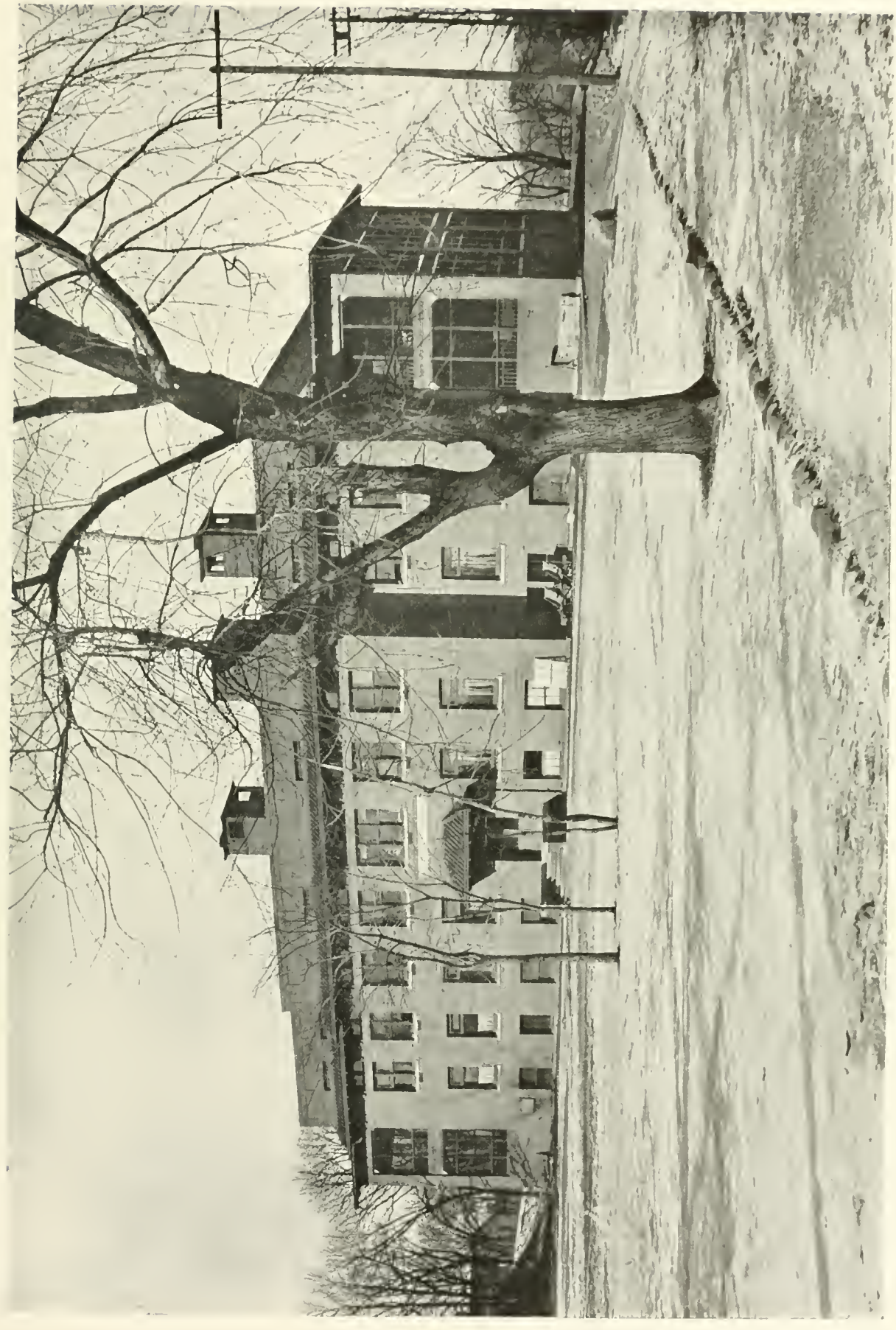
MESSRS. RANKIN, KELLOGG & CRANE, ARCHITECTS

CONNECTING ARCADE

STATE ASYLUM FOR THE CHRONIC INSANE, WERNERSVILLE, PA.

MESSRS. RANKIN, KELLOGG & CRANE, ARCHITECTS

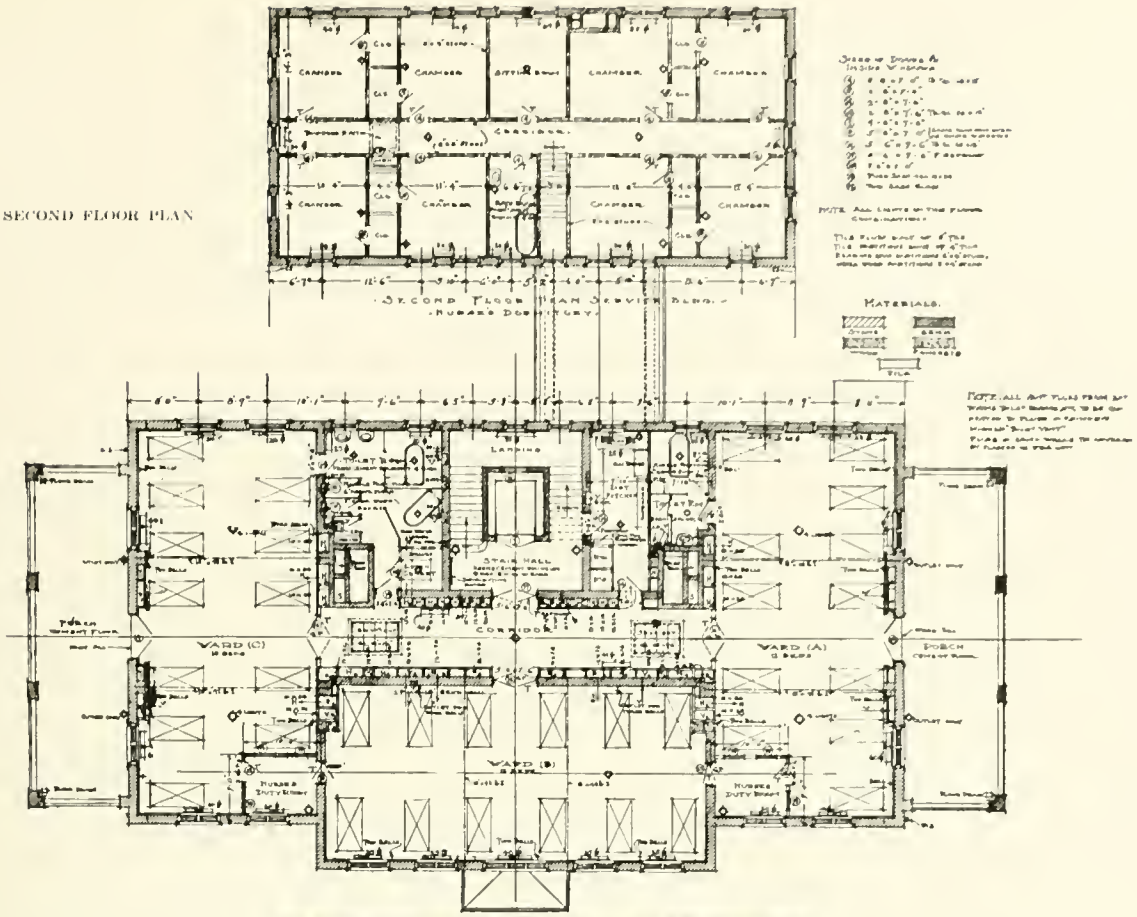
PLATE 65



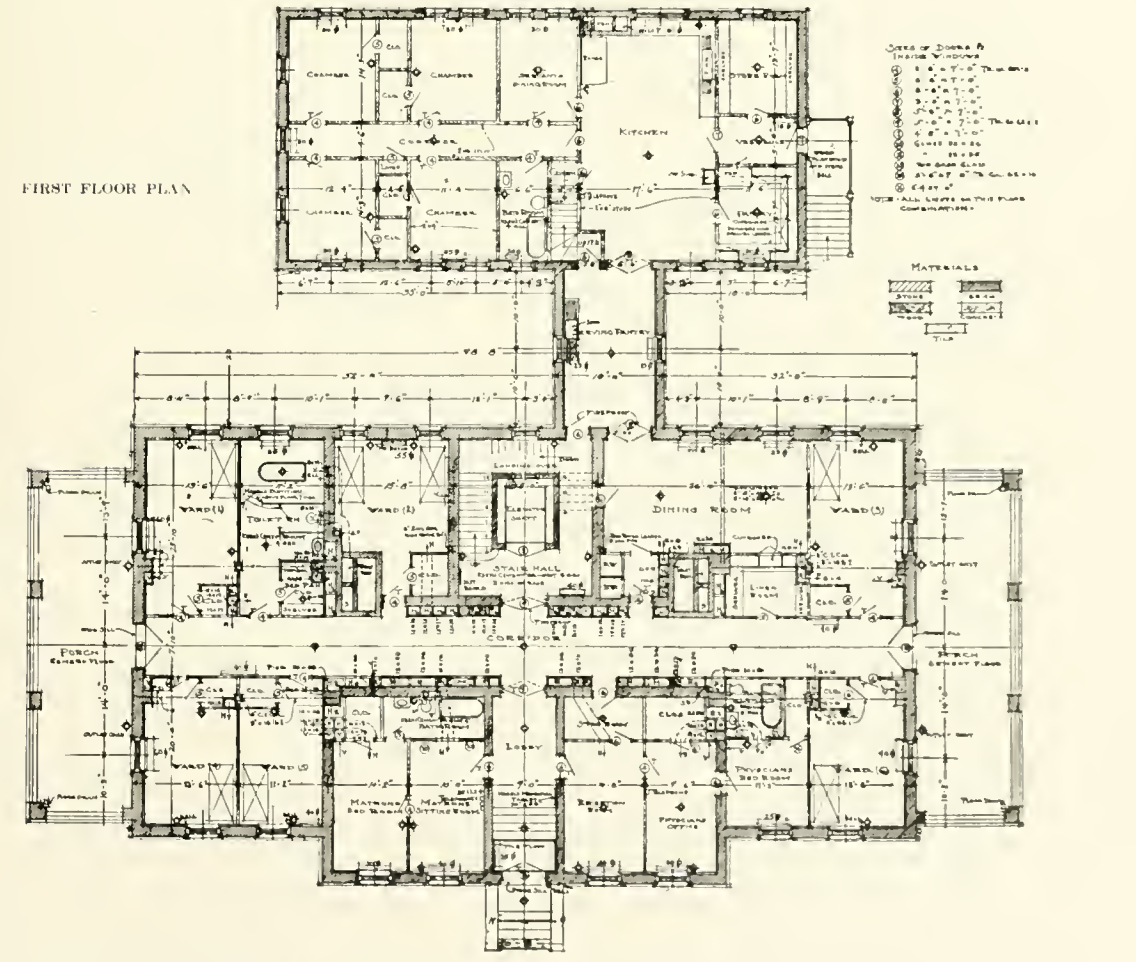
THOMAS MEMORIAL HOSPITAL FOR CONSUMPTIVES, MINNEAPOLIS, MINN.

MESSRS. HEWITT & BROWN, ARCHITECTS

SECOND FLOOR PLAN



FIRST FLOOR PLAN

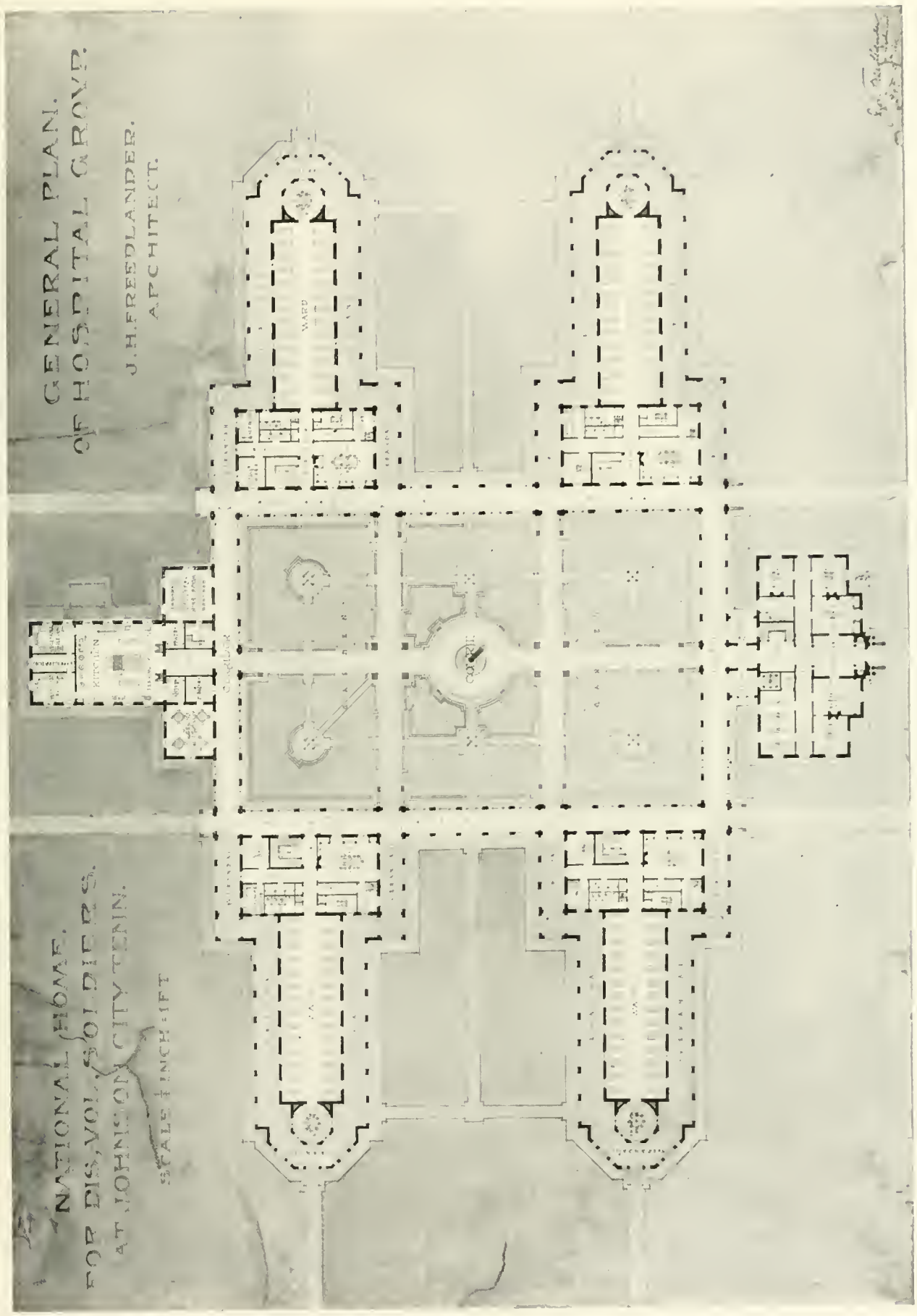


THOMAS MEMORIAL HOSPITAL FOR CONSUMPTIVES, MINNEAPOLIS, MINN.

MESSRS. HEWITT & BROWN, ARCHITECTS

HOSPITAL GROUP—NATIONAL HOME FOR DISABLED VOLUNTEER SOLDIERS, JOHNSON CITY, TENN.

MR. J. H. FREEDLANDER, ARCHITECT



NATIONAL HOME FOR DISABLED VOLUNTEER SOLDIERS, JOHNSON CITY, TENN.

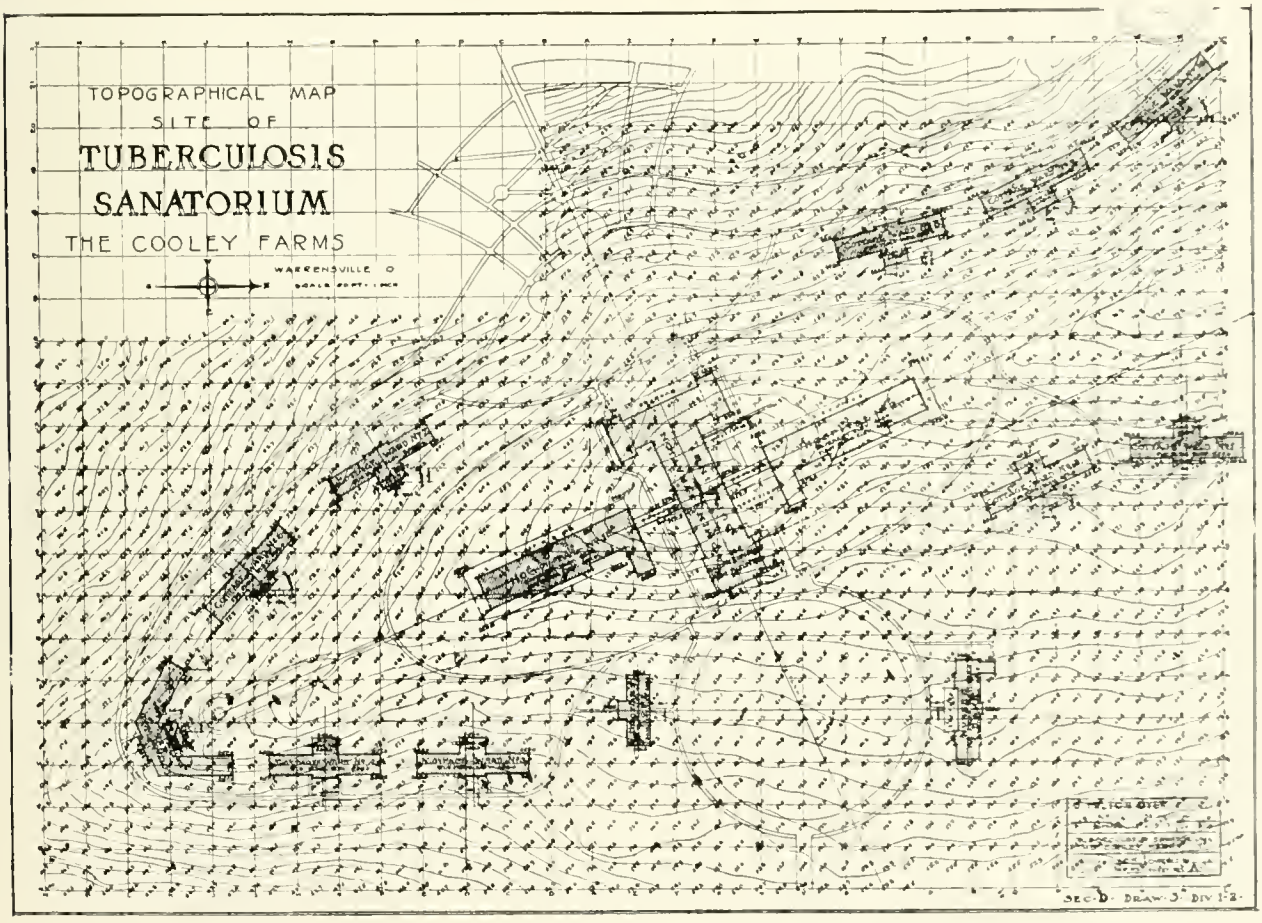
MR. J. H. FREEDLANDER, ARCHITECT

HOSPITAL LOOKING SOUTH

NATIONAL HOME FOR DISABLED VOLUNTEER SOLDIERS, JOHNSON CITY, TENN.

MR. J. H. FREEDLANDER, ARCHITECT

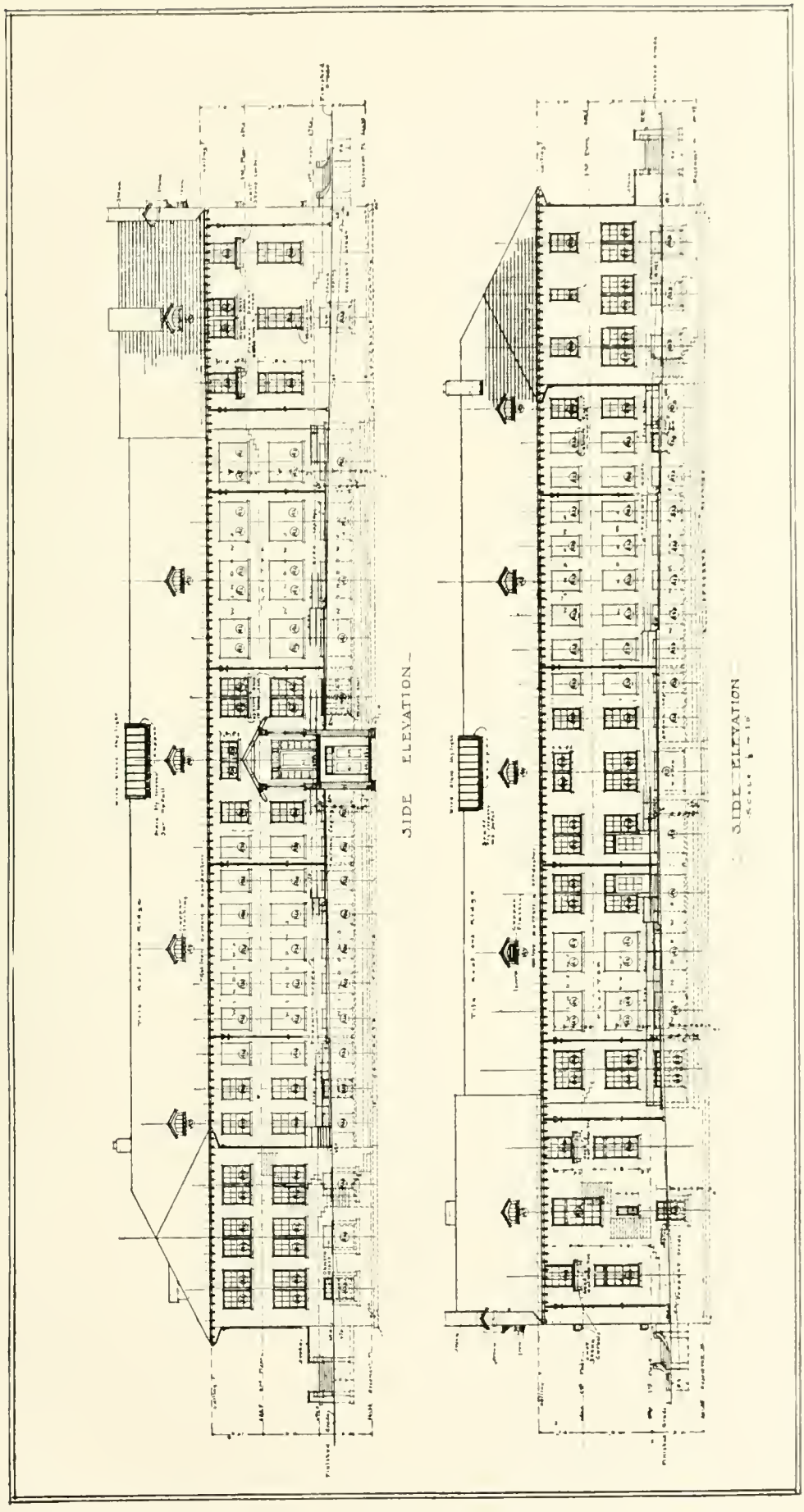
PLATE 70



THE COOLEY FARMS TUBERCULOSIS SANATORIUM, WARRENSVILLE, OHIO

MR. J. MILTON DYER, ARCHITECT

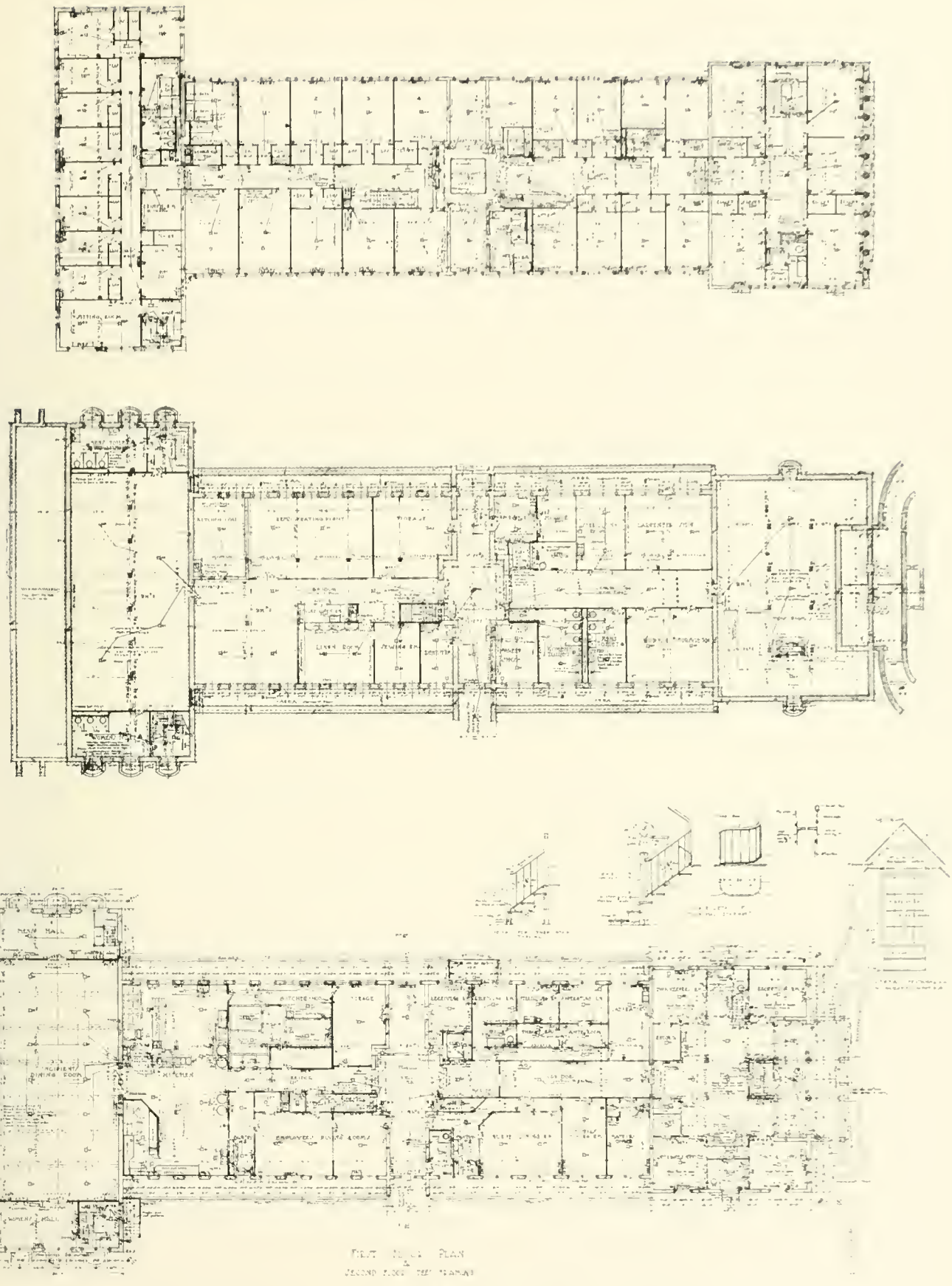
PLATE 71



ADMINISTRATION BUILDING

THE COOLEY FARMS TUBERCULOSIS SANATORIUM, WARRENSVILLE, OHIO

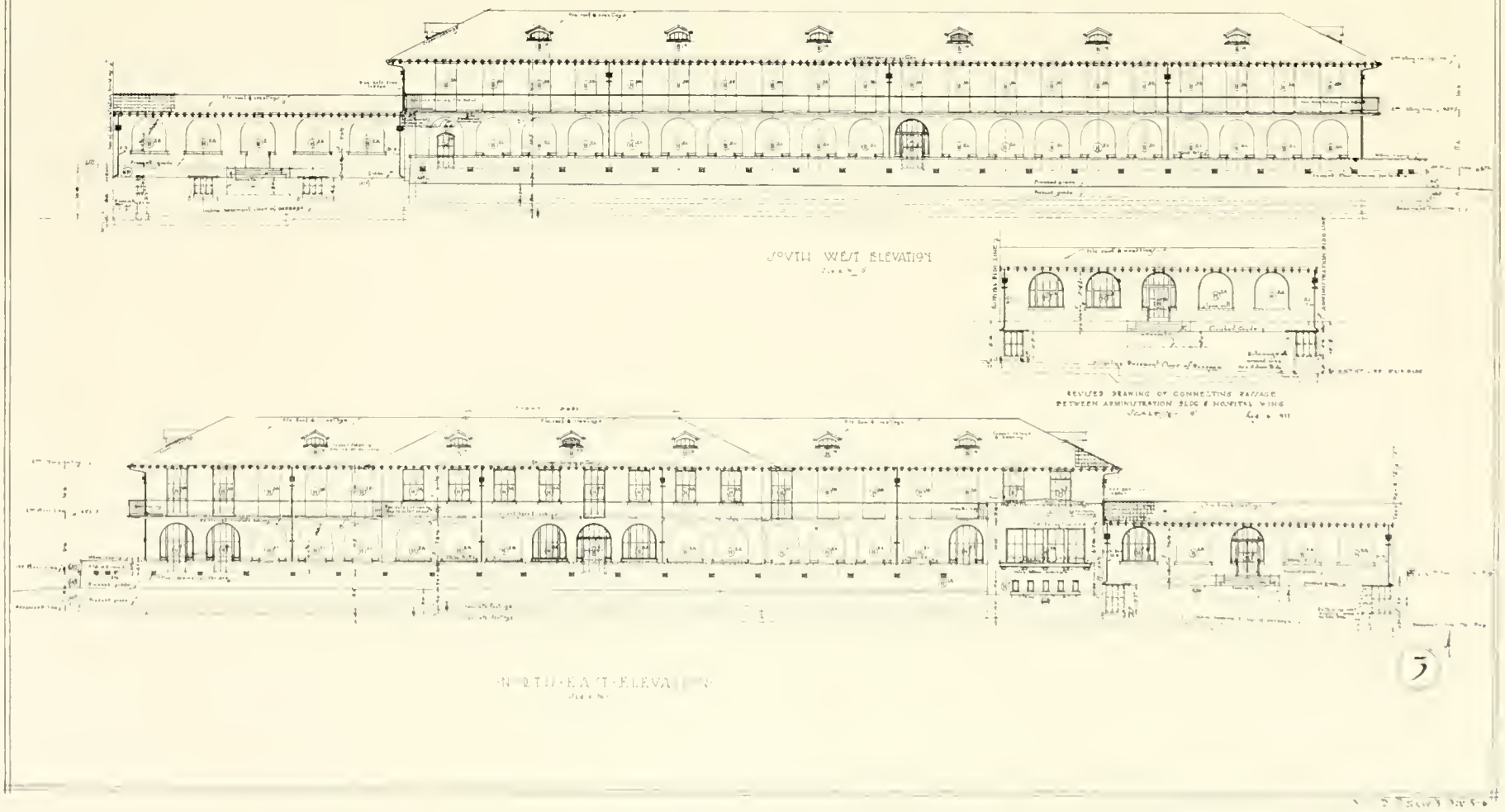
MR. J. MILTON DYER, ARCHITECT



ADMINISTRATION BUILDING

THE COOLEY FARMS TUBERCULOSIS SANATORIUM, WARRENSVILLE, O.

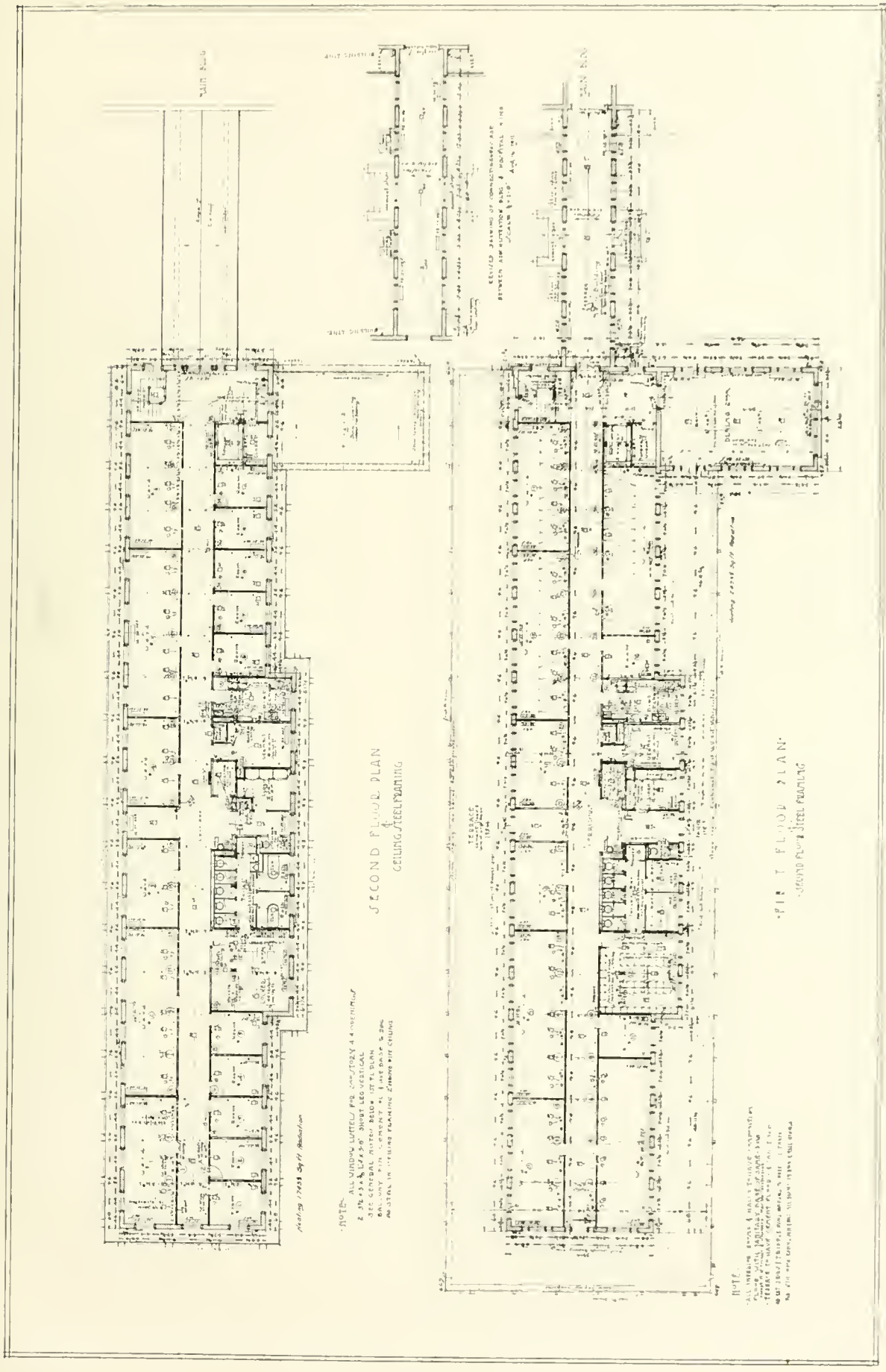
MR. J. MILTON DYER ARCHITECT



HOSPITAL BUILDING

THE COOLEY FARMS TUBERCULOSIS SANATORIUM, WARRENSVILLE, OHIO

MR. J. MILTON DYER, ARCHITECT

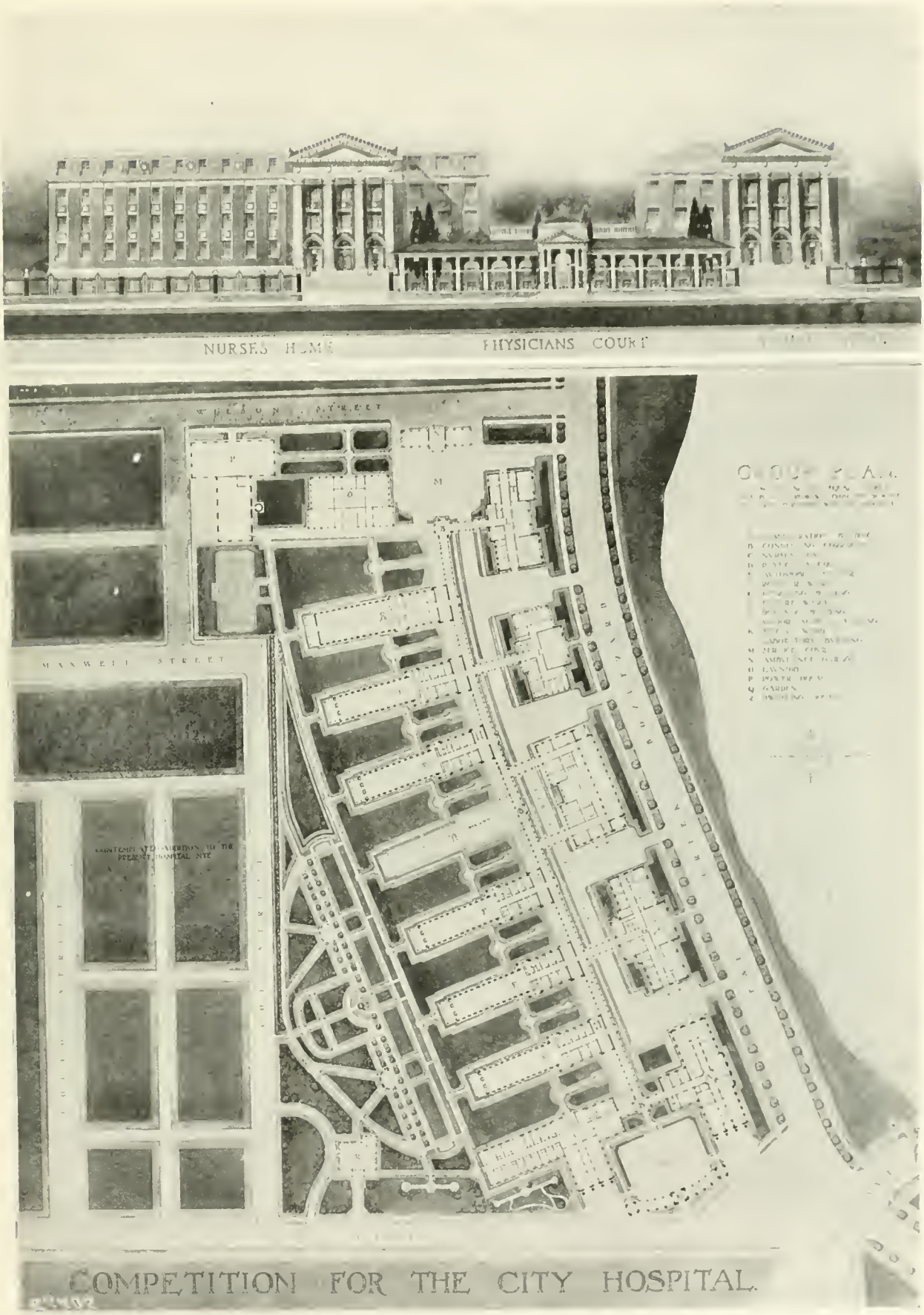


HOSPITAL BUILDING

THE COOLEY FARMS TUBERCULOSIS SANATORIUM, WARRENSVILLE, OHIO

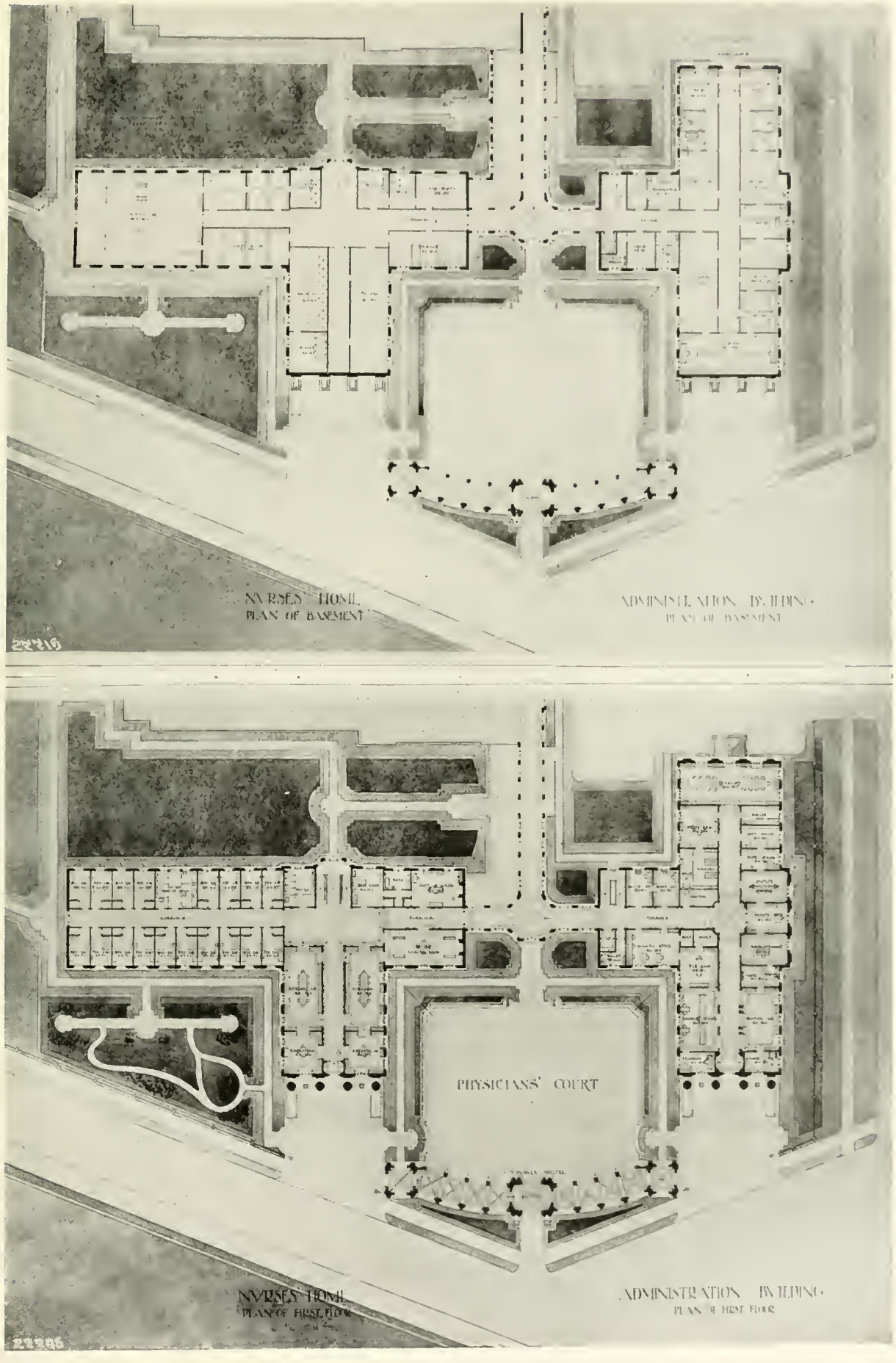
MR. J. MILTON DYER, ARCHITECT

PLATE 75



INDIANAPOLIS, IND., CITY HOSPITAL.

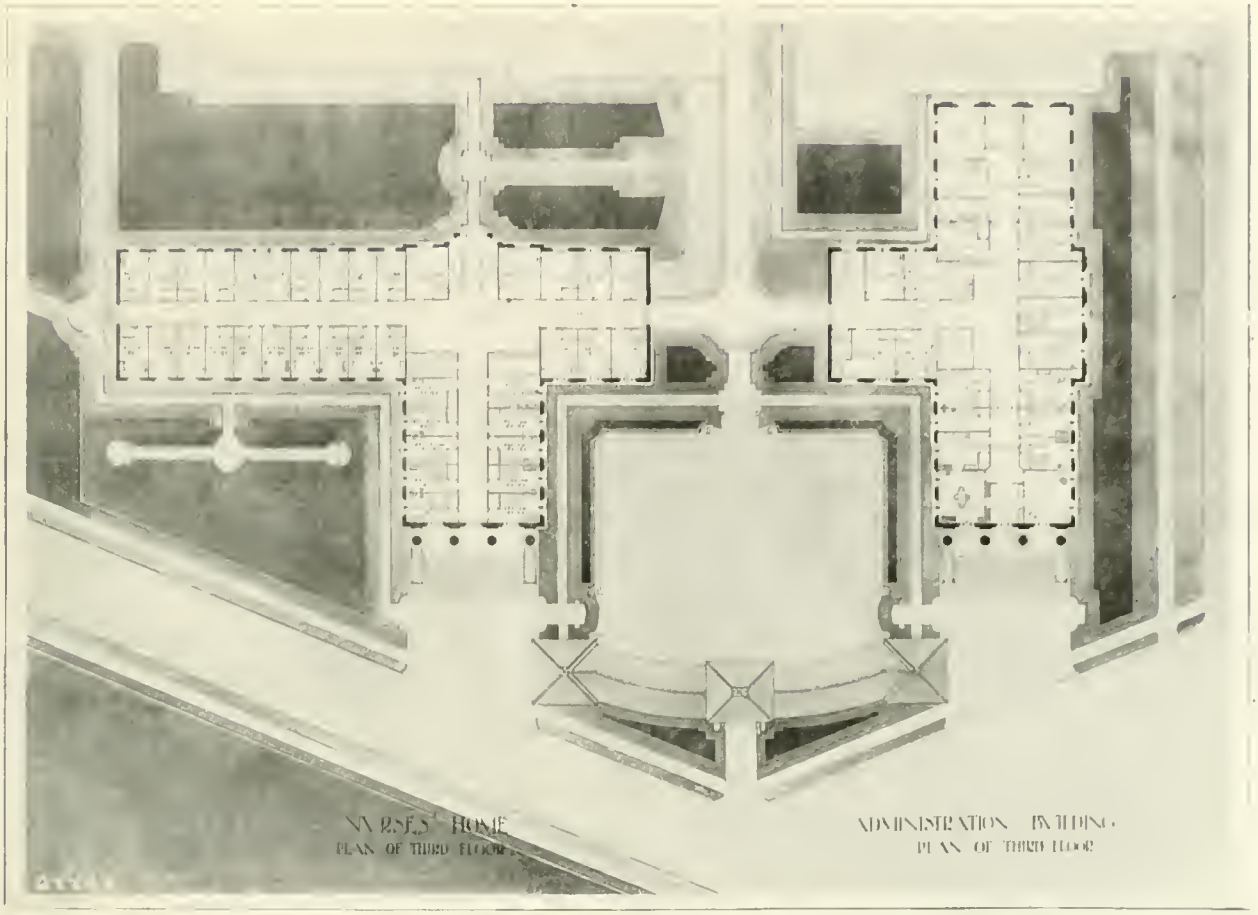
MR. ADOLF SCHERRER, ARCHITECT

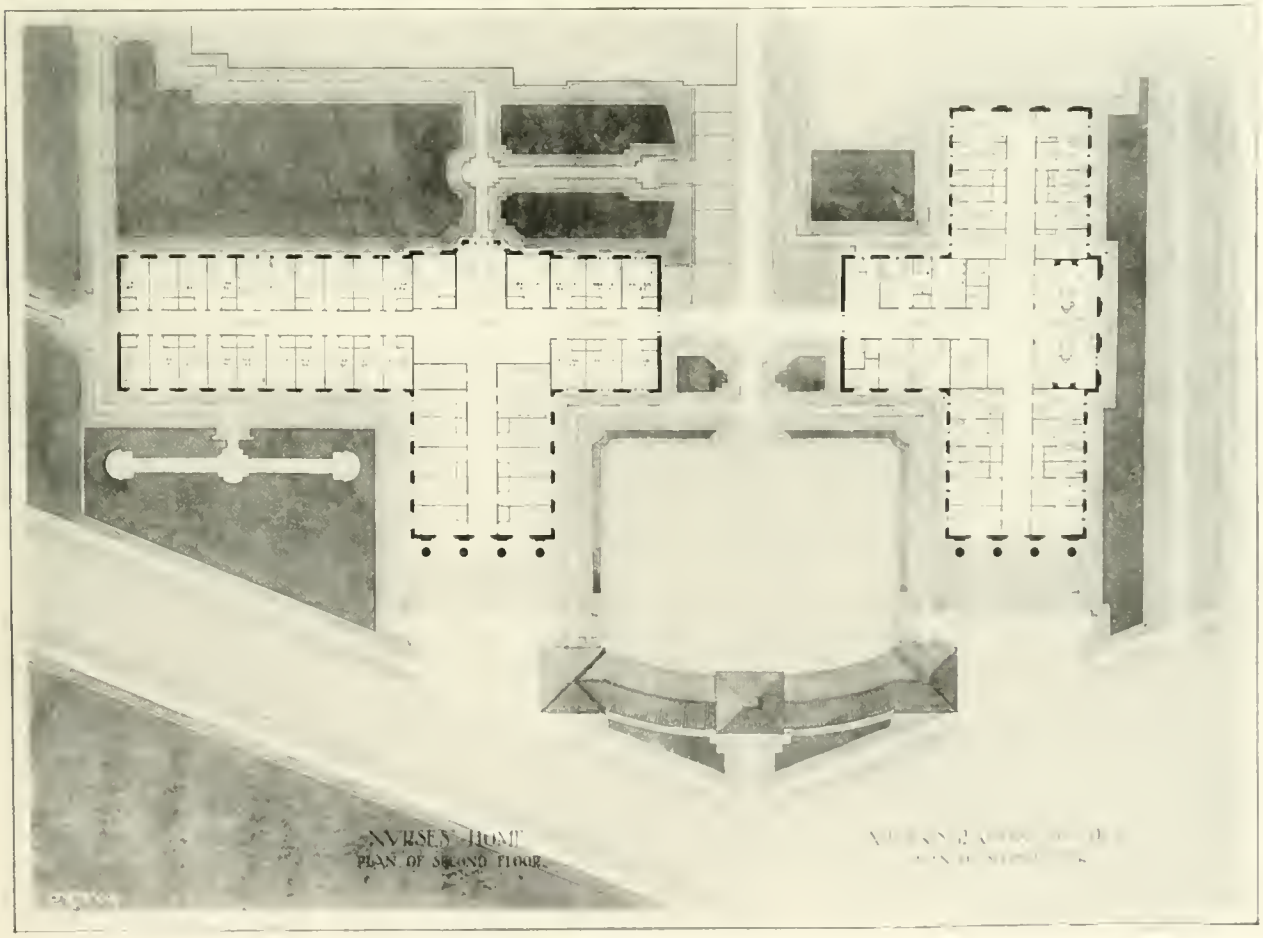


INDIANAPOLIS, IND., CITY HOSPITAL

MR. ADOLF SCHERRER, ARCHITECT

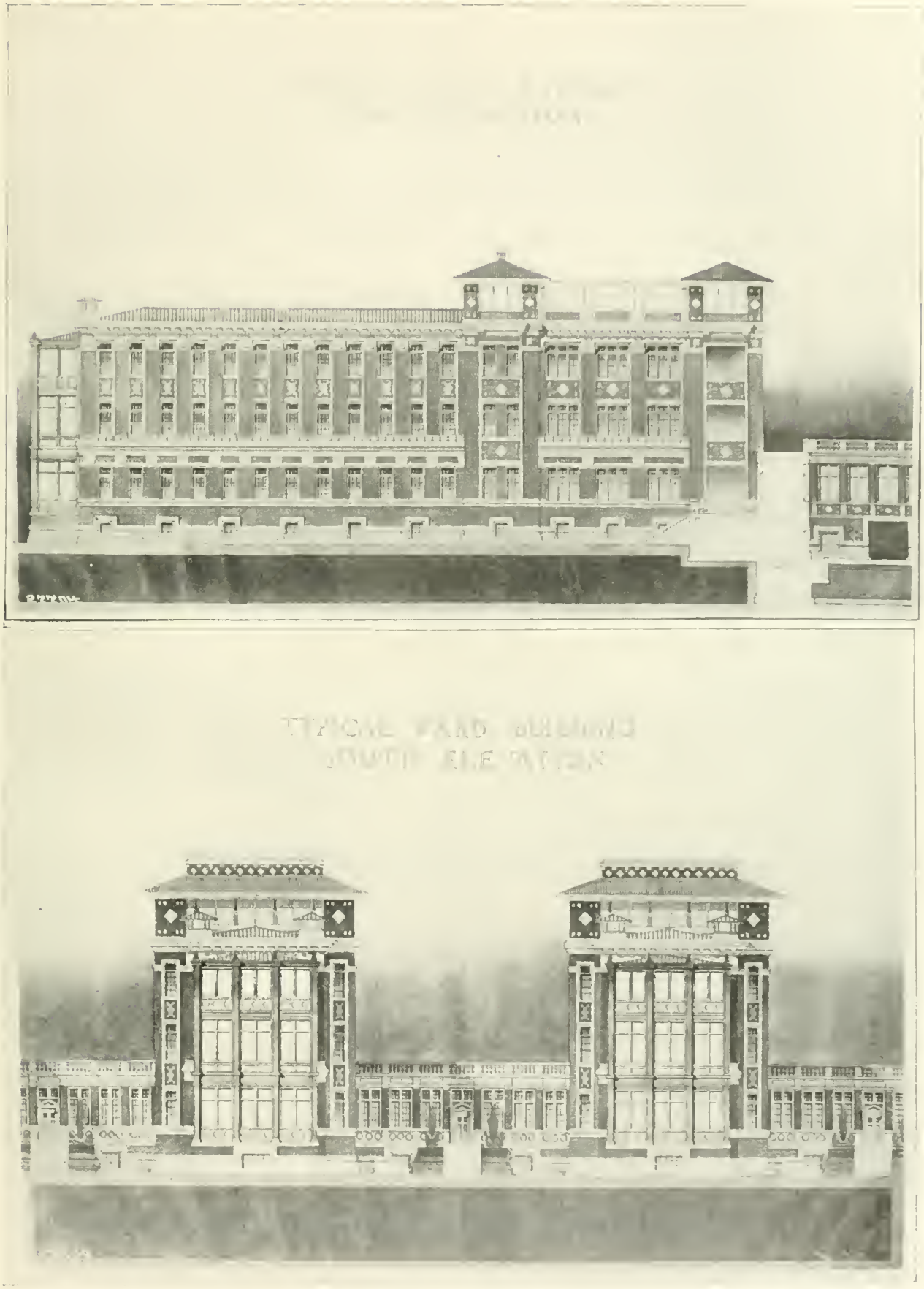
PLATE 77





INDIANAPOLIS, IND., CITY HOSPITAL

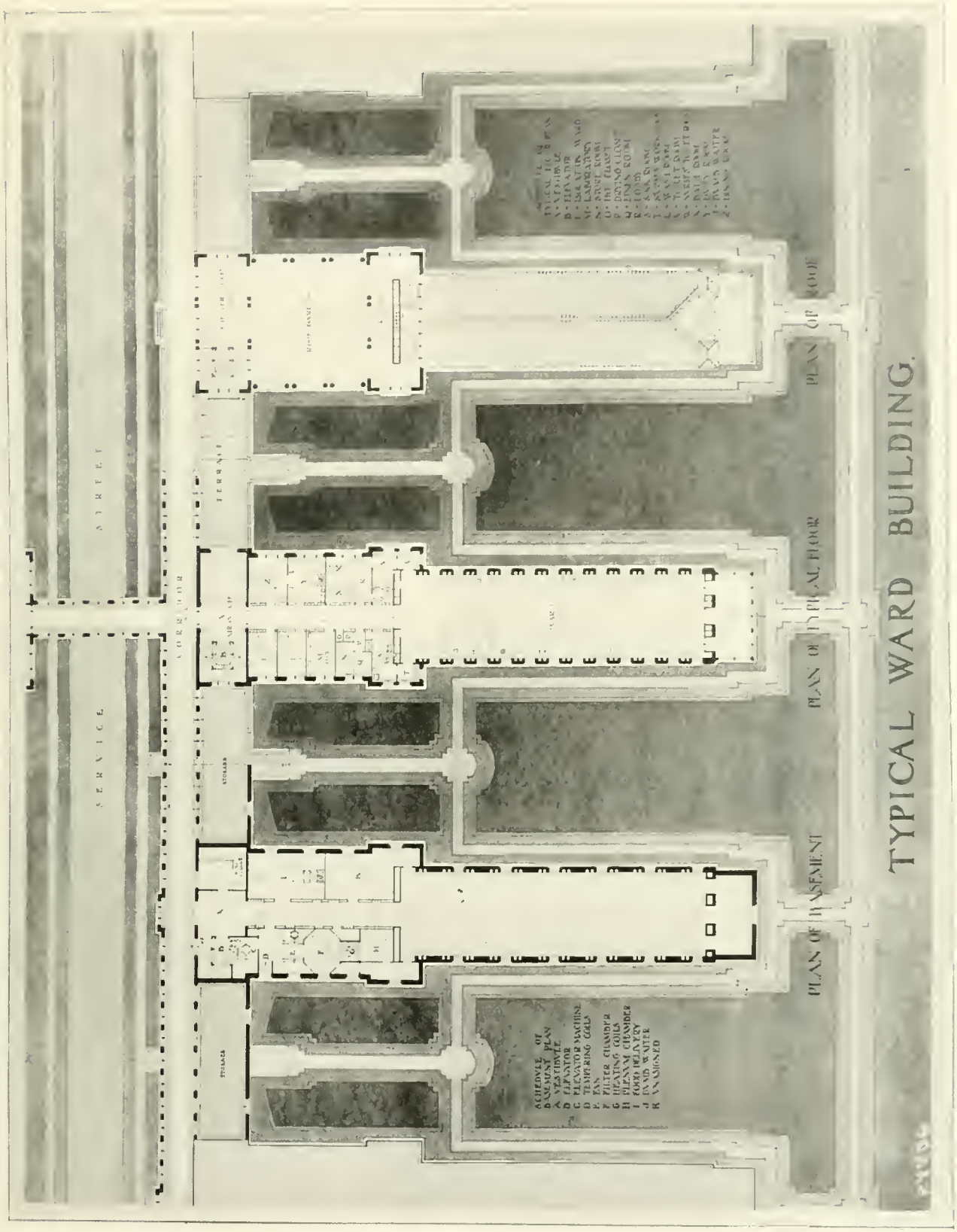
MR. ADOLF SCHERRER, ARCHITECT



INDIANAPOLIS, IND., CITY HOSPITAL

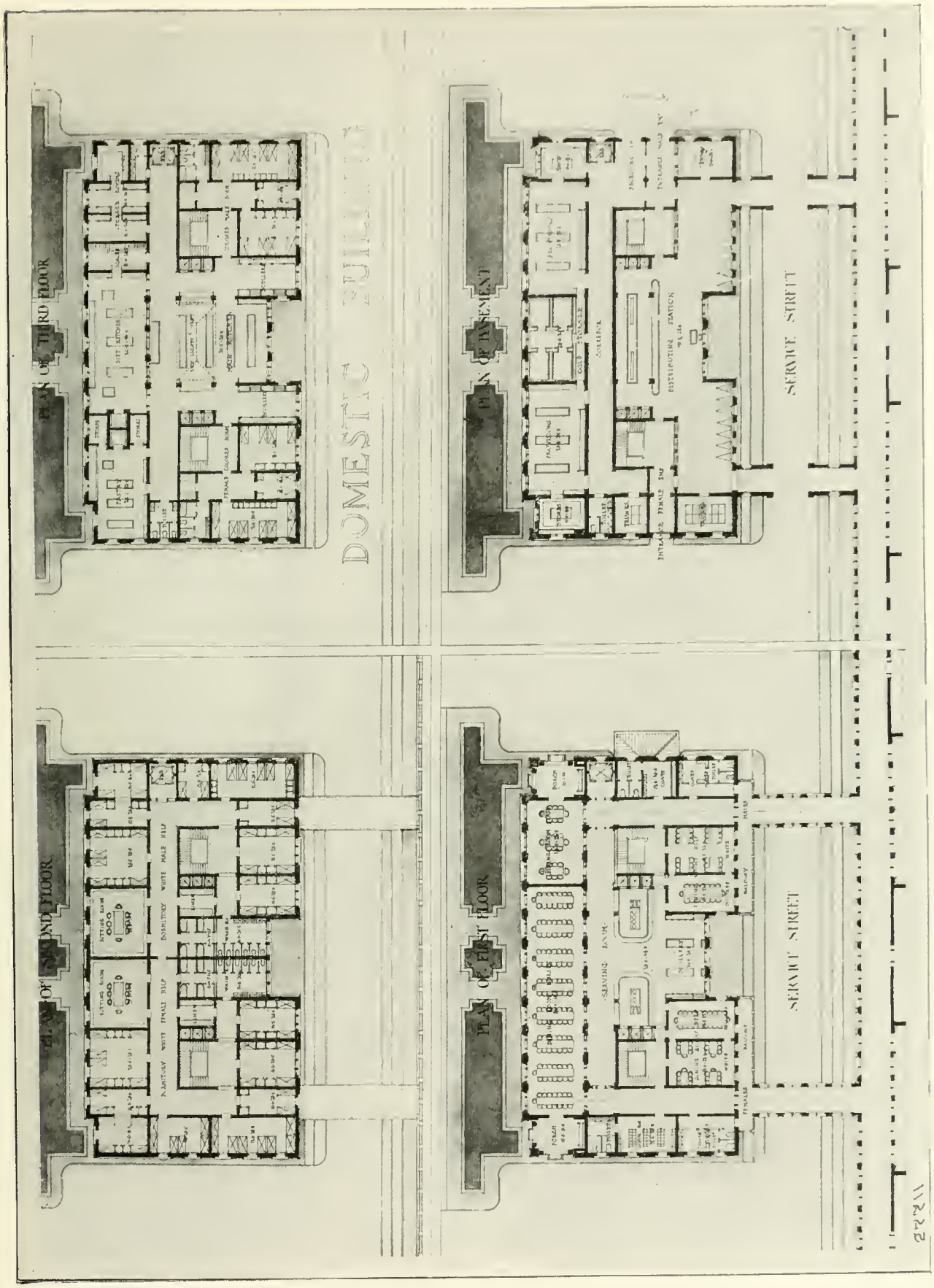
MR. ADOLF SCHERRER, ARCHITECT

PLATE 79



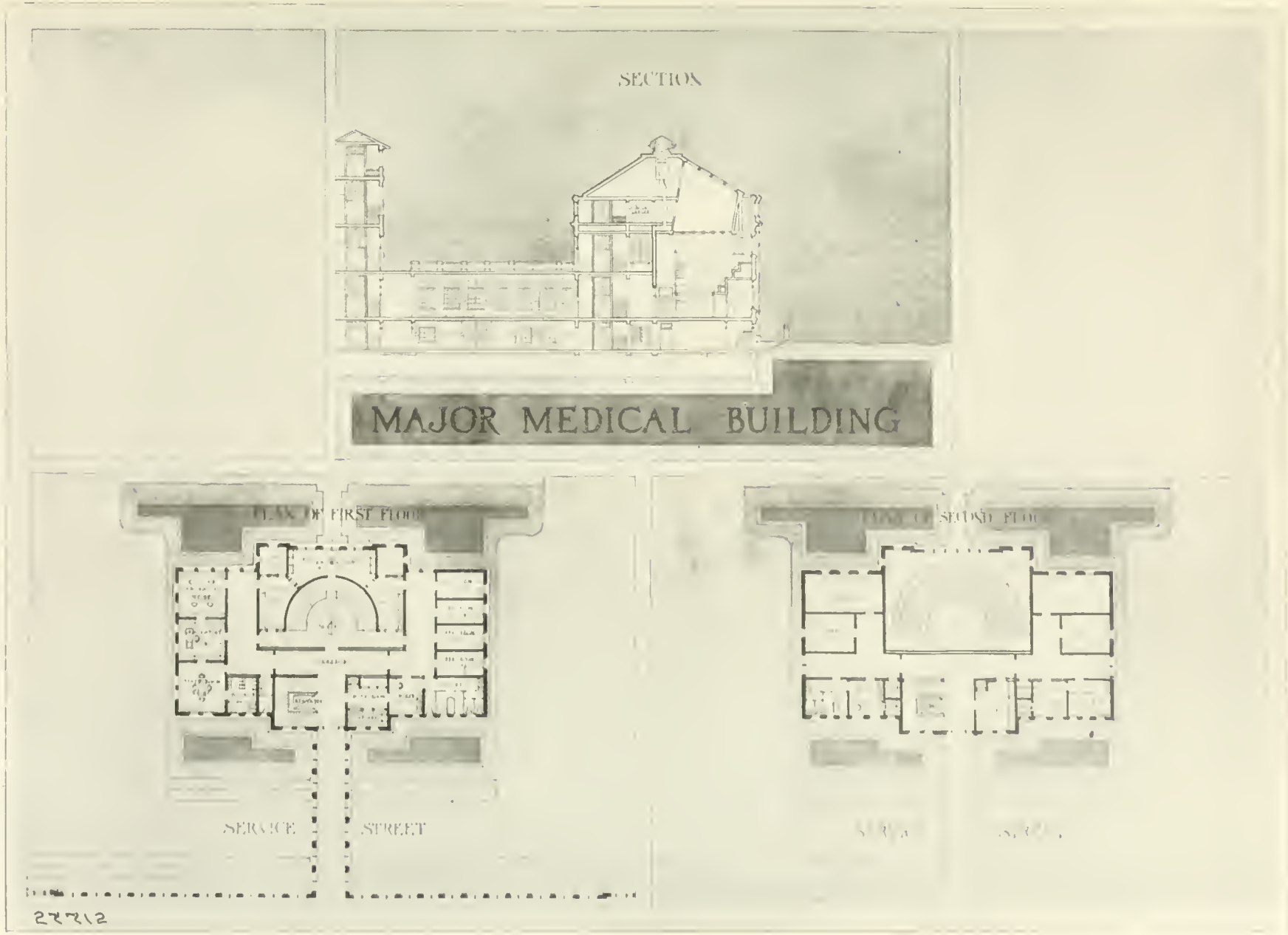
INDIANAPOLIS, IND., CITY HOSPITAL

MR. ADOLF SCHERRER, ARCHITECT



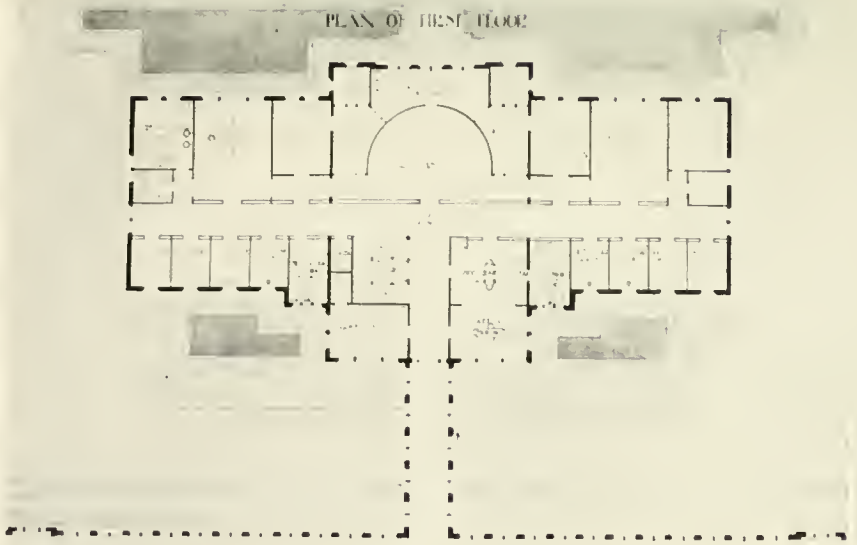
INDIANAPOLIS, IND., CITY HOSPITAL

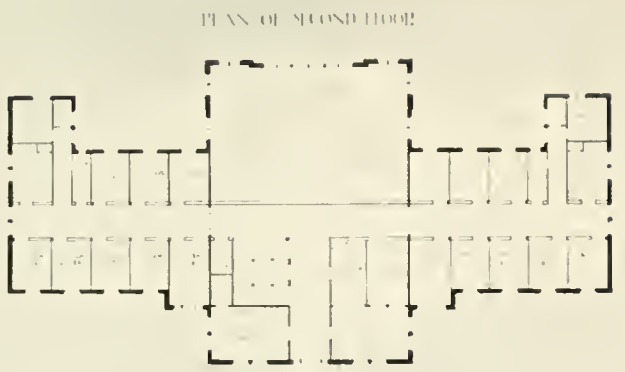
MR. ADOLF SCHERRER, ARCHITECT

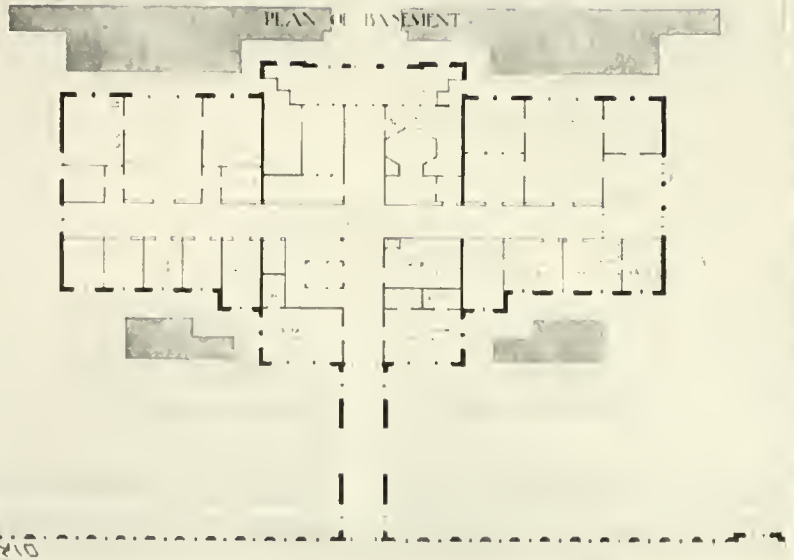


INDIANAPOLIS, IND., CITY HOSPITAL

MR. ADOLF SCHERRER, ARCHITECT



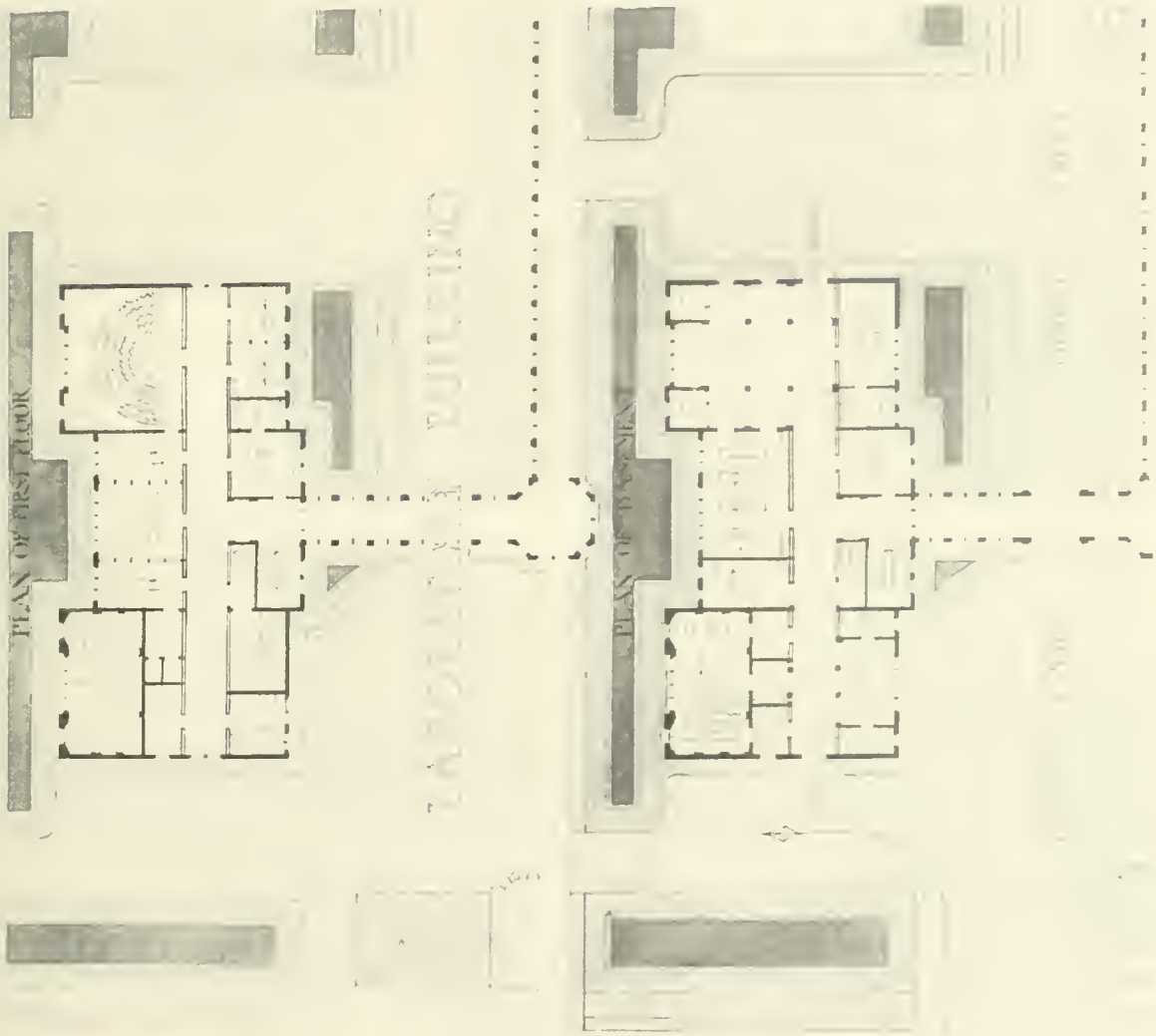




OPERATING BUILDING.

INDIANAPOLIS, IND., CITY HOSPITAL.

MR. ADOLF SCHERRER, ARCHITECT



INDIANAPOLIS, IND., CITY HOSPITAL

MR. ADOLF SCHERRER, ARCHITECT

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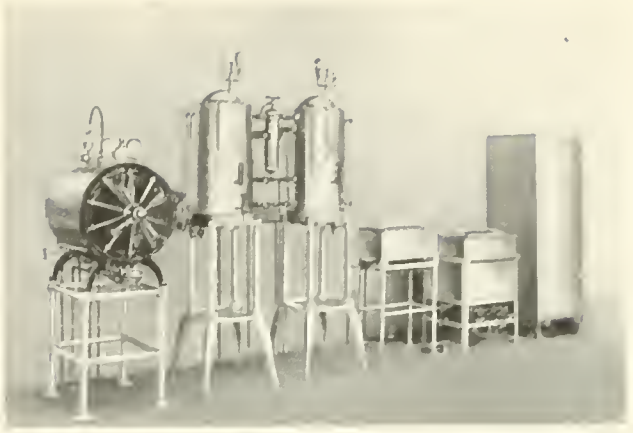
Modern Hospital Equipment



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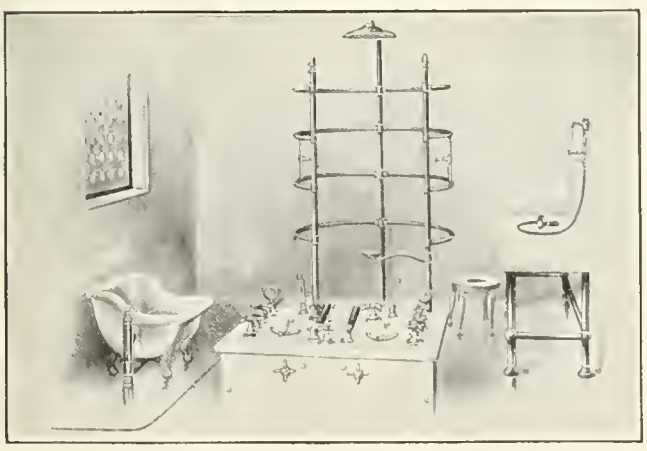

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